DOCUMENT RESUME

ED 209 106 SE 035 862

AUTHOR	Yager, Robert E.
TITLE	Analysis of Current Accomplishments and Needs in Science Education.
INSTITUTION	ERIC Clearinghouse for Science, Mathematics, and Environmental Education, Columbus, Ohio.
SPONS AGENCY	National Inst. of Education (ED), Washington, D.C.
PUB DATE	Dec 80
CONTRACT	400-78-0004
NOTE	342p.
AVAILABLE FROM	Information Reference Center (ERIC/IRC), The Ohio State Univ., 1200 Chambers Rd., 3rd Floor, Columbus, OH 43212 ($8.50).
EDRS PRICE	MF01/PC14 Plus Postage.
DESCRIPTORS	College Science; *Educational Assessment; *Educational Needs; *Educational Objectives; Elementary School Science; Elementary Secondary Education; Higher Education; *National Surveys; Needs Assessment; Science Curriculum; *Science Education; *Science Instruction; Science Supervision; Science Teachers; Secondary School Science; Teacher Education
IDENTIFIERS	Science and Society; *Science Education Research

ABSTRACT

A Working Paper, "Science Education: Accomplishment and Needs," published by the National Science Teachers Association (NSTA) in 1978 was intended as an evolutionary document to be an assessment of the accomplishments and needs of science education perceived at that time. The Working Paper was organized into four major divisions: (1) Introduction; (2) Aims of Science Teaching; (3) Present Conditions of Science Teaching; and (4) Recommendations for the Coming Years. This document is an outgrowth of that earlier Working Paper and reports the views, perceptions, and insights of the science education leadership (100 elementary teachers; 100 secondary teachers; 100 supervisors; 100 teacher educators; and 100 researchers) related to the major divisions of the earlier Working Paper. The NSTA Division of Research used an opinionnaire and written dialogue to survey 500 individuals concerning their level of agreement on the major points of the original Working Paper. The results of this survey are presented. A list of participants and the opinionnaire used are included in the appendices. (DC)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED209106

U.S. DEPARTMENT OF EDUCATION
NATIONAL INSTITUTE OF EDUCATION
EDUCATIONAL RESOURCES INFORMATION
CENTER (ERIC)

☒ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

- Points of view or opinions stated in this document do not necessarily represent official NIE position or policy.

SCIE
EDU
INFO
REPO

SCIENCE
EDUCATION
INFORMATION
REPORT

THE ERIC SCIENCE, MATHEMATICS AND ENVIRONMENTAL EDUCATION CLEARINGHOUSE
in cooperation with
Center for Science and Mathematics Education
The Ohio State University

SE 035 862

2

Robert E. Yager

Coordinator of Science Education
University of Iowa
Iowa City, Iowa 52242

and

Director of Division of Research
National Science Teachers Association (1978-81)

Analysis of Current Accomplishments and Needs in Science Education

ERIC® Center for Science, Mathematics,
and Environmental Education
College of Education
The Ohio State University
1200 Chambers Road, Third Floor
Columbus, Ohio 43212

December, 1980

FOREWORD

When the Working Paper, SCIENCE EDUCATION: ACCOMPLISHMENTS AND NEEDS, was published it was identified as an evolutionary document intended to be an assessment of the accomplishments and needs of science education as perceived at that time. The present document, ANALYSIS OF CURRENT ACCOMPLISHMENTS AND NEEDS IN SCIENCE EDUCATION, is an outgrowth of that earlier Working Paper and reports the views, perceptions, and insights of five groups of people. These five groups were chosen from the leadership of the National Science Teachers Association (NSTA), Council for Elementary Science International (CESI), National Science Supervisors Association (NSSA), Association for the Education of Teachers in Science (AETS), and the National Association for Research in Science Teaching (NARST).

ERIC/SMEAC invites comments, ideas about the future of science education, and reactions to this publication. Such material should be sent to the National Science Teachers Association, 1742 Connecticut Avenue, N.W., Washington, DC 20009.

Stanley L. Helgeson
Associate Director
Science Education

Patricia E. Blosser
Faculty Research Associate
Science Education
ERIC/SMEAC

This publication was prepared with funding from the National Institute of Education, U.S. Department of Education under contract no. 400-78-0004. The opinions expressed in this report do not necessarily reflect the positions or policies of NIE or U.S. Department of Education.

Acknowledgements

This study of an earlier analysis of the Accomplishments and Needs of Science Education during the past quarter century has been completed with the involvement, encouragement, and assistance of many. Robert Silber, Executive Director of the National Science Teachers Association from 1974 to 1979, was intimately involved with the genesis of the paper in cooperation with Robert Howe, Director of ERIC/SMEAC which provided funds. The effort has been on-going for five years, first involving a committee of twenty-five approved in 1976 by the Board of Directors of the National Science Teachers Association (NSTA). The first report was prepared by a committee of eight, with four additional persons contributing in a major way with writing and editing. Many NSTA members reacted to various drafts.

At the 1979 meeting of the NSTA Board of Directors, Board Member Patricia E. Blosser recommended that the Working Paper, which was published in December of 1978, be referred to the new Research Committee for study and analysis. Dr. Blosser, a member of the ERIC/SMEAC staff, and Dr. Stanley L. Helgeson, Associate Director of ERIC/SMEAC, have both contributed significantly to the analysis, the publication of the working paper, the design of this study, and the preparation of the final report. Their interest, support, and efforts are gratefully acknowledged.

The work of the five association presidents who provided the five hundred person leadership group which provided the insights, comments, and ratings which comprise the basic information reported in this study is deeply appreciated. These persons include Robert A. Dean, 1979 President of the National Science Supervisors Association, Doris R. Ensminger, 1979 President of the Council for Elementary Science International, Ertle Thompson, 1979 President of the Association for the Education of Teachers of Science, John W. Renner, 1979 President of the National Association for Research in Science Teaching, and Donald W. McCurdy, 1980 President of the National Science Teachers Association. Their assistance with the identification of leadership in their respective associations who served as respondents, their critiques of several drafts of the questionnaire, and their suggestions of the final draft of this report are acknowledged.

Members of the 1979-1980 and the 1980-1981 NSTA Research Committee also assisted with the design of the study, the preparation of the questionnaire, and the editing of the final report. These persons include the following:

Robert C. Fullerton (1979-81)
Richard McQueen (1979-81)

Arthur L. White (1979-81)
John M. Fowler (1979-81)
Melinda Small (1979-80)
Robert L. Fisher (1979-80)
Walter S. Smith (1979-80)
Michael J. Wavering (1980-81)
Lily Holloway (1980-81)

Several members of the Science Education Center staff contributed much during the 1980 year during which the survey was conducted. Robin Kroloff worked diligently with the sample instrument. Research analysts included Mary Beth Kelley-Lowe, Peggy Jo Christensen, and Sandra Pellens. Preparation of the final draft included Gla Rolig, Marcia Schemper, and Ginger Russell. Without the help of these persons, the report could not have been prepared. Many long hours were required.

Finally, my faculty colleagues at the University of Iowa were generous in assisting with other duties, permitting me to be involved with the project. Daniel S. Sheldon, Vincent N. Lunetta, and Darrell G. Phillips were especially helpful with suggestions and editing.

The efforts of many have been mentioned by name. Surely those who agreed to help with the analysis, especially those who completed the extensive questionnaire, are to be thanked. These names are included in the Appendix of the report.

All who have been involved are convinced that the report has meaning and that it suggests directions and priorities for Science Education for the 80's. Thanks for much effort is due all who helped; this thanks can come from the use of the findings reported.

Robert E. Yager

ANALYSIS OF CURRENT ACCOMPLISHMENTS AND NEEDS IN SCIENCE EDUCATION

Table of Contents

Acknowledgements....................................... i
Table of Contents....................................... iii
Table of Tables....................................... iva
Table of Graphs....................................... va

Executive Summary....................................... 1

I. The Problem and Organization of Report....................... 5

II. Review of Working Paper....................................... 9
  A. Analysis of Introduction Section....................... 9
  B. Analysis of Aims of Science Teaching Section............ 29
  C. Analysis of Section on the Present Situation of Science Teaching....................................... 51
  D. Analysis of Section on Recommendations for the Coming Years....................................... 119

III. General Analysis of Working Paper............................ 257

IV. Accomplishments and Needs in Science Education: A Summary... 267

References....................................... 271

Appendices

  A. Five Leadership Groups Used in the Evaluation of the Working Paper....................................... 273
  B. The Instrument Used to Assess the Validity of the Working Paper....................................... 299

Table of Tables

Page

A 1. Interdependence of Society and Science Teaching as a Point of Departure

A 1.1 Result of Respondent Ratings.......................... 13
A 1.2 Categorization of Open-Ended Responses................. 14
A 1.3 Tabulation of Open-Ended Responses Which Extend Position.. 15-16
A 1.4 Tabulation of Open-Ended Responses Which Take Exception to Position.................................. 17-18
A 1.5 Tabulation of Open-Ended Responses Which Disagree With Position..................................... 19

A 2. Societal Problems Should Provide the Most Significant Influences on Science Teaching for the 80's

A 2.1 Result of Respondent Ratings.......................... 20
A 2.2 Categorization of Open-Ended Responses................. 21
A 2.3 Tabulation of Open-Ended Responses Which Extend Position.. 22
A 2.4 Tabulation of Open-Ended Responses Which Take Exception to Position.................................. 23-24
A 2.5 Tabulation of Open-Ended Responses Which Disagree With Position.. 25

A 3. General Reaction to "Introduction"

A 3.1 Categorization of Open-Ended Responses................. 26
A 3.2 Tabulation of Open-Ended Responses Listing the Points of Disagreement (Elementary Teachers).................
Tabulation of Open-Ended Responses Listing the Points of Disagreement (Secondary Teachers)..................
Tabulation of Open-Ended Responses Listing the Points of Disagreement (Supervisors).........................
Tabulation of Open-Ended Responses Listing the Points of Disagreement (Teacher Educators)...................
Tabulation of Open-Ended Responses Listing the Points of Disagreement (Researchers)........................ 27-28

B 1. Forty Years of Agreement on Goals for Science Teaching

B 1.1 Result of Respondent Ratings.......................... 33
B 1.2 Categorization of Open-Ended Responses................. 34
B 1.3 Tabulation of Open-Ended Responses Which Suggest Major Goals....................................... 35

Page

B 2. The NSTA Description of a Scientifically Literate Person Continues to be Accurate

B 2.1 Result of Respondent Ratings.......................... 36
B 2.2 Categorization of Open-Ended Responses.................. 37
B 2.3 Tabulation of Open-Ended Responses Listing New Features Suggested.................................. 38

B 3. Current Goals are in Period of Significant Transition

B 3.1 Result of Respondent Ratings.......................... 39
B 3.2 Tabulation of Open-Ended Comments Describing New Directions of Science Education........................ 40-41

B 4. Changes with Respect to Goals, Curriculum, and Teaching Strategies are to be Expected

B 4.1 Result of Respondent Ratings.......................... 42
B 4.2 Categorization of Open-Ended Responses................ 43
B 4.3 Tabulation of Open-Ended Responses Which Extend the Position.. 44
B 4.4 Tabulation of Open-Ended Responses Which Take Exception to Position.................................. 45
B 4.5 Tabulation of Open-Ended Responses Which Disagree with Position... 46

B 5. General Reaction to the "Aims" Section and a Listing of Specific Points of Disappointment

B 5.1 Result of Respondent Ratings.......................... 47
B 5.2 Tabulation of Open-Ended Responses Listing Points of Disappointment (Elementary Teachers)
Tabulation of Open-Ended Responses Listing Points of Disappointment (Secondary Teachers)
Tabulation of Open-Ended Responses Listing Points of Disappointment (Supervisors)
Tabulation of Open-Ended Responses Listing Points of Disappointment (Teacher Educators)
Tabulation of Open-Ended Responses Listing Points of Disappointment (Researchers)....................... 48-49

Page

C 1. Science Curriculum Materials Developed During 1959-79 Were Significant Contributions

C 1.1 Result of Respondent Ratings.......................... 61
C 1.2 Categorization of Open-Ended Responses................. 62
C 1.3 Tabulation of Open-Ended Responses Which Extend Position... 63
C 1.4 Tabulation of Open-Ended Responses Which Take Exception to Position.................................. 64
C 1.5 Tabulation of Open-Ended Responses Which Disagree with Position.. 65

C 2. There is Continuous Evolution of Materials and Teaching Approaches 1960 to Present

C 2.1 Result of Respondent Ratings.......................... 66
C 2.2 Categorization of Open-Ended Responses................. 67
C 2.3 Tabulation of Open-Ended Responses Which Extend Position... 68
C 2.4 Tabulation of Open-Ended Responses Which Take Exception to Position.................................. 69
C 2.5 Tabulation of Open-Ended Responses Which Disagree with Position.. 70

C 3. NSF Support for Teacher Education During 1959-79 Resulted in Changes in Teacher Behavior

C 3.1 Result of Respondent Ratings.......................... 71
C 3.2 Categorization of Open-Ended Responses................. 72
C 3.3 Tabulation of Open-Ended Responses Which Extend Position... 73
C 3.4 Tabulation of Open-Ended Responses Which Take Exception to Position.................................. 74
C 3.5 Tabulation of Open-Ended Responses Which Disagree with Position.. 75

C 4. Major Need for 80's is for Science Teachers to be More Knowledgeable About Specific Strategies for Meeting Goals

C 4.1 Result of Respondent Ratings.......................... 76
C 4.2 Categorization of Open-Ended Responses................. 77
C 4.3 Tabulation of Open-Ended Responses Which Extend Position... 78
C 4.4 Tabulation of Open-Ended Responses Which Take Exception to Position.................................. 79
C 4.5 Tabulation of Open-Ended Responses Which Disagree with Position.. 80

Page

C 5. Changes in U.S. Population Represent Major Concerns for Science Teaching in 1980

C 5.1 Result of Respondent Ratings.......................... 81
C 5.2 Categorization of Open-Ended Responses................ 82
C 5.3 Tabulation of Open-Ended Responses Which Extend Position.. 83
C 5.4 Tabulation of Open-Ended Responses Which Take Exception to Position............................... 84
C 5.5 Tabulation of Open-Ended Responses Which Disagree with Position..................................... 85

C 6. Decline in Funds for Science Education is Major Concern for the 80's

C 6.1 Result of Respondent Ratings.......................... 86
C 6.2 Categorization of Open-Ended Responses................ 87
C 6.3 Tabulation of Open-Ended Responses Which Extend Position.. 88
C 6.4 Tabulation of Open-Ended Responses Which Take Exception to Position............................... 89
C 6.5 Tabulation of Open-Ended Responses Which Disagree with Position..................................... 90

C 7. The Decline in Numbers of Students in Science Classes is a major cause for alarm in 1980

C 7.1 Result of Respondent Ratings.......................... 91
C 7.2 Categorization of Open-Ended Responses................ 92
C 7.3 Tabulation of Open-Ended Responses Which Extend Position.. 93
C 7.4 Tabulation of Open-Ended Responses Which Take Exception to Position............................... 94
C 7.5 Tabulation of Open-Ended Responses Which Disagree with Position..................................... 95

C 8. Accountability and Competency-Based Programs Represent Major Concerns to Science Education for the 80's

C 8.1 Result of Respondent Ratings.......................... 96
C 8.2 Categorization of Open-Ended Responses................ 97
C 8.3 Tabulation of Open-Ended Responses Which Extend Position.. 98
C 8.4 Tabulation of Open-Ended Responses Which Take Exception to Position............................... 99
C 8.5 Tabulation of Open-Ended Responses Which Disagree with Position..................................... 100

Page

C 9. School Students are Vastly Different Today Which Represents a Major Concern for Science Teaching for the 80's

C 9.1 Result of Respondent Ratings.......................... 101
C 9.2 Categorization of Open-Ended Responses................. 102
C 9.3 Tabulation of Open-Ended Responses Which Extend Position.. 103
C 9.4 Tabulation of Open-Ended Responses Which Take Exception to Position................................ 104
C 9.5 Tabulation of Open-Ended Responses Which Disagree with Position..................................... 105

C 10. Teacher Unionization is a Major Change and a Concern for Science Instruction for the 80's

C 10.1 Result of Respondent Ratings......................... 106
C 10.2 Categorization of Open-Ended Responses................ 107
C 10.3 Tabulation of Open-Ended Responses Which Extend Position...108-109
C 10.4 Tabulation of Open-Ended Responses Which Take Exception to Position............................... 110
C 10.5 Tabulation of Open-Ended Responses Which Disagree with Position.................................... 111

C 11. Rating of Major Concerns for Science Education for the 80's by Five Sample Groups

C 11.1 Result of Respondent Ratings......................... 112

C 12. More Important Concerns in Science Education in the 1980's

C 12.1 Tabulation of Open-Ended Responses That List Important Concerns (Elementary Teachers)
Tabulation of Open-Ended Responses That List Important Concerns (Secondary Teachers)
Tabulation of Open-Ended Responses That List Important Concerns (Supervisors)
Tabulation of Open-Ended Responses That List Important Concerns (Teacher Educators)
Tabulation of Open-Ended Responses That List Important Concerns (Researchers)....................113-115

Page

C 13. General Reaction to "Present Situation of Science Teaching"

C 13.1 Categorization of Open-Ended Responses.............. 116
C 13.2 Tabulation of Open-Ended Responses Listing the Points of Disagreement (Elementary Teachers)
Tabulation of Open-Ended Responses Listing the Points of Disagreement (Secondary Teachers)
Tabulation of Open-Ended Responses Listing the Points of Disagreement (Supervisors)
Tabulation of Open-Ended Responses Listing the Points of Disagreement (Teacher Educators)
Tabulation of Open-Ended Responses Listing the Points of Disagreement (Researchers)............... 117-118

D 1. Attention Should be Directed to a Shortage of Suitable Materials for Science Instruction in the Elementary School

D 1.1 Result of Respondent Ratings........................ 131
D 1.2 Categorization of Open-Ended Responses............... 132
D 1.3 Tabulation of Open-Ended Responses Which Extend the Position.. 133
D 1.4 Tabulation of Open-Ended Responses Which Take Exception to Position.............................. 134
D 1.5 Tabulation of Open-Ended Responses Which Disagree with Position...................................... 135

D 2. Great Diversity in Content and Approach Should be Encouraged in the Junior High School

D 2.1 Results of Respondent Ratings....................... 136
D 2.2 Categorization of Open-Ended Responses.............. 137
D 2.3 Tabulation of Open-Ended Responses Which Extend the Position.. 138
D 2.4 Tabulation of Open-Ended Responses Which Take Exception to Position.............................. 139
D 2.5 Tabulation of Open-Ended Responses Which Disagree with Position...................................... 140

Page

D 3. Laboratory Instruction Should be Encouraged to a Greater Degree

D 3.1 Result of Respondent Ratings........................ 141
D 3.2 Categorization of Open-Ended Responses............. 142
D 3.3 Tabulation of Open-Ended Responses Which Extend the Position.. 143
D 3.4 Tabulation of Open-Ended Responses Which Take Exception to the Position.......................... 144
D 3.5 Tabulation of Open-Ended Responses Which Disagree with Position.. 145

D 4. Laboratories Should be Emphasized More Because They Tend to Improve Student Attitudes Toward Science

D 4.1 Result of Respondent Ratings........................ 146
D 4.2 Categorization of Open-Ended Responses............. 147
D 4.3 Tabulation of Open-Ended Responses Which Extend the Position.. 148
D 4.4 Tabulation of Open-Ended Responses Which Take Exception to the Position.......................... 149
D 4.5 Tabulation of Open-Ended Responses Which Disagree with Position.. 150

D 5. Traditional Offerings Should be Expanded and Organized in Ways Other Than by Discipline

D 5.1 Result of Respondent Ratings........................ 151
D 5.2 Categorization of Open-Ended Responses............. 152
D 5.3 Tabulation of Open-Ended Responses Which Extend the Position.. 153
D 5.4 Tabulation of Open-Ended Responses Which Take Exception to the Position.......................... 154
D 5.5 Tabulation of Open-Ended Responses Which Disagree with Position.. 155

D 6. Science in Community College Tends to be more Flexible and Varied Than in K-12 Schools

D 6.1 Result of Respondent Ratings........................ 156
D 6.2 Categorization of Open-Ended Responses............. 157
D 6.3 Tabulation of Open-Ended Responses Which Extend the Position.. 158
D 6.4 Tabulation of Open-Ended Responses Which Take Exception to the Position.......................... 159
D 6.5 Tabulation of Open-Ended Responses Which Disagree with Position.. 160

Page

D 7. Laboratories Should be Vital Parts of Science Education at the College Level

D 7.1 Result of Respondent Ratings........................ 161
D 7.2 Categorization of Open-Ended Responses............... 162
D 7.3 Tabulation of Open-Ended Responses Which Extend the Position.. 163
D 7.4 Tabulation of Open-Ended Responses Which Take Exception to the Position............................ 164
D 7.5 Tabulation of Open-Ended Responses Which Disagree with Position.. 165

D 8. All Elementary Teachers Should Complete Formal Study in the Earth, Physical, and Biological Science Areas

D 8.1 Result of Respondent Ratings........................ 166
D 8.2 Categorization of Open-Ended Responses............... 167
D 8.3 Tabulation of Open-Ended Responses Which Extend the Position.. 168
D 8.4 Tabulation of Open-Ended Responses Which Take Exception to the Position............................ 169
D 8.5 Tabulation of Open-Ended Responses Which Disagree with Position.. 170

D 9. Correcting Inadequate Science Preparation Should be a Major Priority for Teacher Education Students

D 9.1 Result of Respondent Ratings........................ 171
D 9.2 Categorization of Open-Ended Responses............... 172
D 9.3 Tabulation of Open-Ended Responses Which Exten the Position.. 173
D 9.4 Tabulation of Open-Ended Responses Which Take Exception to the Position............................ 174
D 9.5 Tabulation of Open-Ended Responses Which Disagree with Position.. 175

D 10.1 - D 10.5 Tabulation of Open-Ended Responses Which List Other Major Problems with Teacher Education Programs

D 10.1 Elementary Teachers
Secondary Teachers
Supervisors
Teacher Educators
Researchers.. 176-178

Page

D 11. Teaching K-12 Science as Inquiry Should be a Major Goal for the 80's

D 11.1 Result of Respondent Ratings........................ 179
D 11.2 Categorization of Open-Ended Responses............. 180
D 11.3 Tabulation of Open-Ended Responses Which Extend the Position.. 181
D 11.4 Tabulation of Open-Ended Responses Which Take Exception to the Position........................... 182
D 11.5 Tabulation of Open-Ended Responses Which Disagree with Position.. 183

D 12. Improvement of Teaching Strategies in Science Should be a Major concern for the 80's

D 12.1 Result of Respondent Ratings........................ 184
D 12.2 Categorization of Open-Ended Responses............. 185
D 12.3 Tabulation of Open-Ended Responses Which Extend the Position.. 186
D 12.4 Tabulation of Open-Ended Responses Which Take Exception to the Position........................... 187
D 12.5 Tabulation of Open-Ended Responses Which Disagree with Position.. 188

D 13. Attention to Budgets, Including that for Equipment and Supplies, Should be a Major Concern for the 80's

D 13.1 Result of Respondent Ratings........................ 189
D 13.2 Categorization of Open-Ended Responses............. 190
D 13.3 Tabulation of Open-Ended Responses Which Extend the Position.. 191
D 13.4 Tabulation of Open-Ended Responses Which Take Exception to the Position........................... 192
D 13.5 Tabulation of Open-Ended Responses Which Disagree with Position.. 193

D 14. Renewed Attention to In-Service Teacher Education Should be a Major Priority in the 80's

D 14.1 Result of Respondent Ratings........................ 194
D 14.2 Categorization of Open-Ended Responses............. 195
D 14.3 Tabulation of Open-Ended Responses Which Extend the Position.. 196
D 14.4 Tabulation of Open-Ended Responses Which Take Exception to the Position........................... 197
D 14.5 Tabulation of Open-Ended Responses Which Disagree with Position.. 198

Page

D 15. Attention to the Employment of Additional Consultants and Other Support Staff Should be a Major Priority of the 80's

D 15.1 Result of Respondent Ratings 199
D 15.2 Categorization of Open-Ended Responses 200
D 15.3 Tabulation of Open-Ended Responses Which Extend Position 201
D 15.4 Tabulation of Open-Ended Responses Which Take Exception to the Position 202
D 15.5 Tabulation of Open-Ended Responses Which Disagree with Position 203

D 16. Schools and School Personnel Should be Involved to a Greater Degree in Pre-Service Education

D 16.1 Result of Respondent Ratings 204
D 16.2 Categorization of Open-Ended Responses 205
D 16.3 Tabulation of Open-Ended Responses Which Extend the Position 206
D 16.4 Tabulation of Open-Ended Responses Which Take Exception to the Position 207
D 16.5 Tabulation of Open-Ended Responses Which Disagree with Position 208

D 17. Competency-Based Teacher Education Programs Should be Encouraged Because of Their Current Importance and Impact

D 17.1 Result of Respondent Ratings 209
D 17.2 Categorization of Open-Ended Responses 210
D 17.3 Tabulation of Open-Ended Responses Which Extend the Position 211
D 17.4 Tabulation of Open-Ended Responses Which Take Exception to the Position 212
D 17.5 Tabulation of Open-Ended Responses Which Disagree with Position 213

D 18. Greater Community Involvement in Science Curriculum, Teaching, and Direct Student Experiences Should be Encouraged

D 18.1 Result of Respondent Ratings 214
D 18.2 Categorization of Open-Ended Responses 215
D 18.3 Tabulation of Open-Ended Responses Which Extend the Position 216
D 18.4 Tabulation of Open-Ended Responses Which Take Exception to the Position 217
D 18.5 Tabulation of Open-Ended Responses Which Disagree with Position 218

Page

D 19. Additional Research in Science Education Should be Encouraged and Supported

D 19.1 Result of Respondent Ratings 219
D 19.2 Categorization of Open-Ended Responses 220
D 19.3 Tabulation of Open-Ended Responses Which Extend the Position 221
D 19.4 Tabulation of Open-Ended Responses Which Take Exception to the Position 222
D 19.5 Tabulation of Open-Ended Responses Which Disagree with Position 223

D 20. More Cooperation Between Practitioner and Researcher Should be a Major Priority for the 80's

D 20.1 Result of Respondent Ratings 224
D 20.2 Categorization of Open-Ended Responses 225
D 20.3 Tabulation of Open-Ended Responses Which Extend the Position 226
D 20.4 Tabulation of Open-Ended Responses Which Take Exception to the Position 227
D 20.5 Tabulation of Open-Ended Responses Which Disagree with Position 228

D 21. Encouragement of Women and Minorities in Science Should be a Major Priority for Attention During the 80's

D 21.1 Result of Respondent Ratings 229
D 21.2 Categorization of Open-Ended Responses 230
D 21.3 Tabulation of Open-Ended Responses Which Extend the Position 231
D 21.4 Tabulation of Open-Ended Responses Which Take Exception to the Position 232
D 21.5 Tabulation of Open-Ended Responses Which Disagree with Position 233

D 22. Curriculum Dissemination and Implementation Activities Should be Given a Higher Priority by NSF

D 22.1 Result of Respondent Ratings 234
D 22.2 Categorization of Open-Ended Responses 235
D 22.3 Tabulation of Open-Ended Responses Which Extend the Position 236
D 22.4 Tabulation of Open-Ended Responses Which Take Exception to the Position 237
D 22.5 Tabulation of Open-Ended Responses Which Disagree with Position 238

Page

D 23. Support for In-Service Teacher Education Activities Should be Given a Higher Priority in NSF

D 23.1 Result of Respondent Ratings........................ 239
D 23.2 Categorization of Open-Ended Responses............. 240
D 23.3 Tabulation of Open-Ended Responses Which Extend the Position....................................... 241
D 23.4 Tabulation of Open-Ended Responses Which Take Exception to the Position.......................... 242
D 23.5 Tabulation of Open-Ended Responses Which Disagree with Position.. 243

D 24. Financial Support for Science Education Should be Significantly Increased for the Next Decade

D 24.1 Result of Respondent Ratings........................ 244
D 24.2 Categorization of Open-Ended Responses............. 245
D 24.3 Tabulation of Open-Ended Responses Which Extend the Position....................................... 246
D 24.4 Tabulation of Open-Ended Responses Which Take Exception to the Position.......................... 247
D 24.5 Tabulation of Open-Ended Responses Which Disagree with Position.. 248

D 25. Science Education Community Should Constantly Assess its Needs, Define its Problems, and Establish New Goals

D 25.1 Result of Respondent Ratings........................ 249
D 25.2 Categorization of Open-Ended Responses............. 250
D 25.3 Tabulation of Open-Ended Responses Which Extend the Position....................................... 251
D 25.4 Tabulation of Open-Ended Responses Which Take Exception to the Position.......................... 252
D 25.5 Tabulation of Open-Ended Responses Which Disagree with Position.. 253

D 26. General Reaction to "Recommendations for Coming Years"

D 26.1 Categorization of Open-Ended Responses............. 254
D 26.2 Tabulation of Open-Ended Responses Listing the Points of Disagreement (Elementary Teachers)
Tabulation of Open-Ended Responses Listing the Points of Disagreement (Secondary Teachers)
Tabulation of Open-Ended Responses Listing the Points of Disagreement (Supervisors)
Tabulation of Open-Ended Responses Listing the Points of Disagreement (Teacher Educators)
Tabulation of Open-Ended Responses Listing the Points of Disagreement (Researchers).............. 255

Table of Graphs

Page

A 1. Interdependence of Society and Science Teaching as a Point of Departure

A 1.1 Graphic Presentation of Respondent Ratings............. 13
A 1.2 Graphic Presentation of Open-Ended Responses........... 14

A 2. Societal Problems Should Provide the Most Significant Influences on Science Teaching for the 80's

A 2.1 Graphic Presentation of Respondent Ratings............. 20
A 2.2 Graphic Presentation of Open-Ended Responses........... 21

A 3. General Reaction to "Introduction"

A 3.1 Graphic Presentation of Open-Ended Responses........... 26

B 1. Forty Years of Agreement on Goals for Science Teaching

B 1.1 Graphic Presentation of Respondent Ratings............. 33
B 1.2 Graphic Presentation of Open-Ended Responses........... 34

B 2. The NSTA Description of a Scientifically Literate Person Continues to be Accurate

B 2.1 Graphic Presentation of Respondent Ratings............. 36
B 2.2 Graphic Presentation of Open-Ended Responses........... 37

B 3. Current Goals are in Period of Significant Transition

B 3.1 Graphic Presentation of Respondent Ratings............. 39

B 4. Changes with Respect to Goals, Curriculum, and Teaching Strategies are to be Expected

B 4.1 Graphic Presentation of Respondent Ratings............. 42
B 4.2 Graphic Presentation of Open-Ended Responses........... 43

Page

B 5. General Reaction to the "Aims" Section and a Listing of Specific Points of Disappointment

B 5.1 Graphic Presentation of Respondent Ratings............. 47

C 1. Science Curriculum Materials Developed During 1959-79 were Significant Contributions

C 1.1 Graphic Presentation of Respondent Ratings............. 61
C 1.2 Graphic Presentation of Open-Ended Responses........... 62

C 2. There is Continuous Evolution of Materials and Teaching Approaches 1960 to Present

C 2.1 Graphic Presentation of Respondent Ratings............. 66
C 2.2 Graphic Presentation of Open-Ended Responses........... 67

C 3. NSF Support for Teacher Education During 1959-79 Resulted in Changes in Teacher Behavior

C 3.1 Graphic Presentation of Respondent Ratings............. 71
C 3.2 Graphic Presentation of Open-Ended Responses........... 72

C 4. Major Need for 80's is for Science Teachers to be More Knowledgeable About Specific Strategies for Meeting Goals

C 4.1 Graphic Presentation of Respondent Ratings............. 76
C 4.2 Graphic Presentation of Open-Ended Responses........... 77

C 5. Changes in U.S. Population Represent Major Concerns for Science Teaching in 1980

C 5.1 Graphic Presentation of Respondent Ratings............. 81
C 5.2 Graphic Presentation of Open-Ended Responses........... 82

Page

C 6. Decline in Funds for Science Education is Major Concern for the 80's

C 6.1 Graphic Presentation of Respondent Ratings........... 86
C 6.2 Graphic Presentation of Open-Ended Responses......... 87

C 7. The Decline in Numbers of Students in Science Classes is a Major Cause for Alarm in 1980

C 7.1 Graphic Presentation of Respondent Ratings........... 91
C 7.2 Graphic Presentation of Open-Ended Responses......... 92

C 8. Accountability and Competency-Based Programs Represent Major Concerns to Science Education for the 80's

C 8.1 Graphic Presentation of Respondent Ratings........... 96
C 8.2 Graphic Presentation of Open-Ended Responses......... 97

C 9. School Students are Vastly Different Today Which Represents a Major Concern for Science Teaching for the 80's

C 9.1 Graphic Presentation of Respondent Ratings........... 101
C 9.2 Graphic Presentation of Open-Ended Responses......... 102

C 10. Teacher Unionization is a Major Change and a Concern for Science Instruction for the 80's

C 10.1 Graphic Presentation of Respondent Ratings.......... 106
C 10.2 Graphic Presentation of Open-Ended Responses........ 107

C 13. General Reaction to "Present Situation of Science Teaching"

C 13.1 Graphic Presentation of Open-Ended Responses........ 116

Page

D 1. Attention Should be Directed to a Shortage of Suitable Materials for Science Instruction in the Elementary School

D 1.1 Graphic Presentation of Respondent Ratings.......... 131
D 1.2 Graphic Presentation of Open-Ended Responses........ 132

D 2. Great Diversity in Content and Approach Should be Encouraged in the Junior High School

D 2.1 Graphic Presentation of Respondent Ratings.......... 136
D 2.2 Graphic Presentation of Open-Ended Responses........ 137

D 3. Laboratory Instruction Should be Encouraged to a Greater Degree

D 3.1 Graphic Presentation of Respondent Ratings.......... 141
D 3.2 Graphic Presentation of Open-Ended Responses........ 142

D 4. Laboratories Should be Emphasized More Because They Tend to Improve Student Attitudes Toward Science

D 4.1 Graphic Presentation of Respondent Ratings.......... 146
D 4.2 Graphic Presentation of Open-Ended Responses........ 147

D 5. Traditional Offerings Should be Expanded and Organized in Ways Other Than by Discipline

D 5.1 Graphic Presentation of Respondent Ratings.......... 151
D 5.2 Graphic Presentation of Open-Ended Responses........ 152

D 6. Science in Community College Tends to be More Flexible and Varied than in K-12 Schools

D 6.1 Graphic Presentation of Respondent Ratings.......... 156
D 6.2 Graphic Presentation of Open-Ended Responses........ 157

Page

D 7. Laboratories Should Be Vital Parts of Science Education at the College Level

D 7.1 Graphic Presentation of Respondent Ratings........... 161
D 7.2 Graphic Presentation of Open-Ended Responses......... 162

D 8. All Elementary Teachers Should Complete Formal Study in the Earth, Physical, and Biological Science Areas

D 8.1 Graphic Presentation of Respondent Ratings........... 166
D 8.2 Graphic Presentation of Open-Ended Responses......... 167

D 9. Correcting Inadequate Science Preparation Should be a Major Priority for Teacher Education Students

D 9.1 Graphic Presentation of Respondent Ratings........... 171
D 9.2 Graphic Presentation of Open-Ended Responses......... 172

D 11. Teaching K-12 Science as Inquiry Should be a Major Goal for the 80's

D 11.1 Graphic Presentation of Respondent Ratings.......... 179
D 11.2 Graphic Presentation of Open-Ended Responses........ 180

D 12. Improvement of Teaching Strategies in Science Should be a Major Concern for the 80's

D 12.1 Graphic Presentation of Respondent Ratings.......... 184
D 12.2 Graphic Presentation of Open-Ended Responses........ 185

D 13. Attention to Budgets, Including that for Equipment and Supplies, Should be a Major Concern for the 80's

D 13.1 Graphic Presentation of Respondent Ratings.......... 189
D 13.2 Graphic Presentation of Open-Ended Responses........ 190

Page

D 14. Renewed Attention to In-Service Teacher Education Should be a Major Priority in the 80's

D 14.1 Graphic Presentation of Respondent Ratings......... 194
D 14.2 Graphic Presentation of Open-Ended Responses....... 195

D 15. Attention to the Employment of Additional Consultants and Other Support Staff Should be a Major Priority of the 80's

D 15.1 Graphic Presentation of Respondent Ratings......... 199
D 15.2 Graphic Presentation of Open-Ended Responses....... 200

D 16. Schools and School Personnel Should be Involved to a Greater Degree in Pre-Service Education

D 16.1 Graphic Presentation of Respondent Ratings......... 204
D 16.2 Graphic Presentation of Open-Ended Responses....... 205

D 17. Competency-Based Teacher Education Programs Should be Encouraged Because of their Current Importance and Impact

D 17.1 Graphic Presentation of Respondent Ratings......... 209
D 17.2 Graphic Presentation of Open-Ended Responses....... 210

D 18. Greater Community Involvement in Science Curriculum, Teaching, and Direct Student Experiences Should be Encouraged

D 18.1 Graphic Presentation of Respondent Ratings......... 214
D 18.2 Graphic Presentation of Open-Ended Responses....... 215

D 19. Additional Research in Science Education Should be Encouraged and Supported

D 19.1 Graphic Presentation of Respondent Ratings......... 219
D 19.2 Graphic Presentation of Open-Ended Responses....... 220

Page

D 20. More Cooperation Between Practitioner and Researcher Should be a Major Priority for the 80's

D 20.1 Graphic Presentation of Respondent Ratings......... 224
D 20.2 Graphic Presentation of Open-Ended Responses....... 225

D 21. Encouragement of Women and Minorities in Science Should be a Major Priority for Attention During the 80's

D 21.1 Graphic Presentation of Respondent Ratings......... 229
D 21.2 Graphic Presentation of Open-Ended Responses....... 230

D 22. Curriculum Dissemination and Implementation Activities Should be Given a Higher Priority by NSF

D 22.1 Graphic Presentation of Respondent Ratings......... 234
D 22.2 Graphic Presentation of Open-Ended Responses....... 235

D 23. Support for In-Service Teacher Education Activities Should be Given a Higher Priority in NSF

D 23.1 Graphic Presentation of Respondent Ratings......... 239
D 23.2 Graphic Presentation of Open-Ended Responses....... 240

D 24. Financial Support for Science Education Should be Significantly Increased for the Next Decade

D 24.1 Graphic Presentation of Respondent Ratings......... 244
D 24.2 Graphic Presentation of Open-Ended Responses....... 245

D 25. Science Education Community Should Constantly Assess its Needs, Define its Problems, and Establish New Goals

D 25.1 Graphic Presentation of Respondent Ratings......... 249
D 25.2 Graphic Presentation of Open-Ended Responses....... 250

D 26. General Reaction to "Recommendations for Coming Years"

D 26.1 Graphic Presentation of Open-Ended Responses....... 254

Executive Summary

It is generally accepted that taking stock of personal, organizational, societal, or professional accomplishments is a desirable undertaking and one that provides a focus for future needs. The last three years of the decade of the 70's was a time when many in the United States were called upon to engage in self-analysis. Science education was no exception. The National Science Foundation funded three major status studies to review the literature during 1955-75, to assess by means of questionnaires what self-reporting instruments suggest to be current practices, to report via trained observers what can be seen to be occurring in schools. The National Science Foundation also funded nine professional societies representing a wide spectrum of professional perspectives to review the Status Studies in an effort to arrive at the major findings particularly relevant to various groups. In addition, three synthesis studies were funded to establish desired states (what ought to be) while analyzing the actual states (what is) by means of the Status Studies and other current indicators.

The National Science Teachers Association was included as a critical component during this period of national reflection and analysis. It conducted its own assessment of the accomplishments in science education during the period following the launching of the Russian Sputnik in 1957, which resulted in the formulation of specific recommendations for the 80's. A Working Paper (Science Education: Accomplishments and Needs), published in December of 1978, represented the results of more than two years of effort. It stressed an initial concern about current professional problems as well as a need for new directions in response to present and future problems.

During the past two years, the NSTA Division of Research continued with the process through use of an opinionnaire and written dialogue with samples of the science education leadership from a variety of levels; namely, elementary teachers, secondary teachers, supervisors, teacher educators, and researchers. A hundred person sample from each of these groups was asked to respond to forty-six questions, to offer suggestions about each, and to give general comments concerning each of the four major divisions of the Working Paper. The five groups were chosen from the leadership of the National Science Teachers Association (NSTA), Council for Elementary Science International (CESI), National Science Supervisors Association (NSSA), Association for Education of Teachers in Science (AETS), and the National Association for Research in Science Teaching (NARST) respectively.

Generalizations arising from the analysis of the Working Paper include:

1) Most of the specific points made in the Working Paper are points with which most leadership groups agree. These points include: a) a societal setting or framework for science education, b) the emergence of new goals for science teaching, c) some specific accomplishments in the area of curriculum development and the improvement of instruction, and d) an extensive listing of recommendations for the future.

2) Although there was much agreement regarding the major points in the Working Paper, there was general lack of enthusiasm for the writing, the organization, the poignancy of the message. Many see an urgency for a) new framework/domain statements, b) new statements of aims and goals, c) more precise reflections upon past accomplishments, and d) more focused recommendations for action.

3) There is much evidence that various groups within the discipline of science education represent severe divisions which affect professional vitality, the ability to work as parts of a total team, and easy communication within the profession and with the rest of society. There is general agreement concerning a) the urgency of the current situation, b) the need for cooperation, and c) the necessity for action.

Specific areas where agreement and direction are noted include:

1) Emphasis upon science for academic preparation has been a major focus of the past. However, major concern for science as a means of encountering and resolving current societal problems, a means for attending to the personal needs of students, and as a means of approaching greater awareness of career potential in science, technology, and related fields suggest goals that may be far more important than the traditional goal of academic preparation for future courses.

2) Teachers are central in realizing past accomplishments, in planning local programs, in making the difference with learners. Curriculum is seen as a form of support for teachers - not something that will constrict and/or direct them. The necessity for improving teacher education programs (both pre-service and in-service) is viewed as a critical need and one where there is greatest agreement across the profession.

3) Some of the past assumptions regarding science teaching are being questioned. These include:

a) the importance of the laboratory - (a redefinition of laboratory in terms of position in the program is occurring);
b) the appropriateness of inquiry as a focus;
c) the "discipline" organization for secondary courses;
d) a two-dimensional view of science (i.e., content and process) as accurate and/or complete;

e) a focus upon science that is at the "cutting-edge" of researchers (science that is useful in the lives of learners is in evidence);
f) the necessity of science as a precursor for study at the next academic level;
g) the appropriateness of all learners learning the major ideas and the unique processes that professional scientists know and use; and
h) the more science content preparation that a teacher experiences the better the teacher.

4) Continued questioning, assessment, evaluation, and specific new attempts with goals, curriculum, teaching strategies, and support materials and personnel are important as a means for stimulating improvements and for solving many immediate problems. This basic "spirit of science" must be used to a greater degree in science education.

5) There is an urgency concerning the current status of science education in the United States. There is general agreement that science education must act in a concerted fashion in order that educational and societal problems might be confronted and resolved.

There have been many accomplishments in science education since 1957. However, the accomplishments have not prevented the emergence of new problems - many far more urgent than the wounded national pride following the launching of Sputnik. We need to marshall the same and/or greater national resolve to improve science education as a response to current national (and international) problems. Continuing with the same correctives that were designed to solve problems of the 60's is inappropriate. The use of past correctives for a new time plagued with many perplexing problems is not a satisfactory action as we prepare for the future. Without some new directions, the discipline of science education is likely to experience further deterioration. But it is such times of crisis which bring the best ideas - a desire for change - a rebirth.

I. Organization of Report

At the end of 1978, the National Science Teachers Association produced a forty-six page working paper entitled Science Education: Accomplishments and Needs. This paper was the result of nearly three years of study, debate, and analysis involving a special committee, editing subcommittees, the Executive Committee, and the entire twenty-eight member Board of Directors. Much of the debate continued into the year that followed. During the summer of 1979 the Board of Directors of the National Science Teachers Association referred the paper to its Research Committee for further study and recommendation.

Following the action of the Board, the Research Committee decided to study the paper from the perspective of five subgroups, each representing a given segment of the profession. The presidents of NSTA and four of its Division Affiliates met to discuss the study and specific procedures to be followed. These persons included Robert A. Dean, President of the National Science Supervisors Association, Doris R. Ensminger, President of the Council for Elementary Science International, Ertle Thompson, President of the Association for the Education of Teachers of Science, John W. Renner, President of the National Association for Research in Science Teaching, and Donald W. McCurdy, President-Elect of the National Science Teachers Association. The meeting was chaired by Robert E. Yager, Director of the Division of Research of the National Science Teachers Association and Chair of its Research Committee which had been charged with conducting the study. An Ex-Officio member of the design committee included Stanley L. Helgeson, representing ERIC/SMEAC which had agreed to fund the study.

The of the leadership of each of the five associations. This involved five hundred persons responding to a structured inventory designed to find degree of agreement and disagreement on major points in the paper as well as to indicate new ideas and explanations for their individual assessments of various facets of the working paper. This study sample was as follows:

100 Elementary School Teachers of Science (drawn from the leadership of CESI)
100 Secondary School Science Teachers (drawn from the leadership of NSTA)
100 Science Supervisors (drawn from the leadership of NSSA)
100 Science Teacher Educators (drawn from the leadership of AETS)
100 Science Education Education Researchers (drawn from the leadership of NARST)

The five presidents contacted members of their respective associations, asking them to agree to help with the study. These were to be asked to read the working paper and to complete a questionnaire regarding its contents sometime during the winter of 1979 or early spring of 1980. Leaders, for purposes of the study, were defined as persons who served in the five organizations as officers and/or members of committees or who had presented papers at association meetings - all in the past five years. The names of the five hundred persons in the study sample (leaders in CESI, NSTA, NSSA, AETS, and NARST who agreed to participate in the study) are indicated in Appendix A of this report. The five lists were forwarded to the Chairperson of the Research Committee by November 15, 1979.

During September, October, and November of 1979, the members of the Research Committee reviewed the Working Paper and constructed several versions of a questionnaire designed for the study. A semi-final draft of the document was submitted to the ERIC/SMEAC staff. This draft also was circulated to NIE representatives who were responsible for the ERIC/SMEAC funding of the study. A final draft with agreement from members of the Research Committee of NSTA, the five association presidents, the ERIC/SMEAC staff, and representatives of NIE was approved December 1, 1979. A copy of this questionnaire is included as Appendix B.

Copies of the Working Paper, Science Education: Accomplishments and Needs, the questionnaire, and a cover letter to the sample of five hundred science education leaders were mailed from ERIC/SMEAC, Columbus, Ohio, in March, 1980. A letter encouraging all five hundred to respond promptly also was mailed from Iowa City, Iowa, by the Chairperson of the NSTA Research Committee and principal investigator for the effort.

Unfortunately the paper, questionnaire, and cover letter were mailed Third Class and significant numbers did not get to persons who had agreed to participate. Three additional letters were sent to all five hundred persons to verify addresses, their agreement to participate with a new timetable, and their receipt of the paper and questionnaire. During April and May all persons received the survey material, but some asked to delay their responses until the summer months. Two additional reminders were sent to all persons in the sample during the summer.

In September, 1980, initial tabulations were begun. In some cases, however, only 50 percent of the sample had completed the questionnaire. Nonetheless, preliminary reports were prepared and presented at the two fall Area Conventions of NSTA. Some additional questionnaires were secured at these sessions and during the days that followed. The deadline date for completion of questionnaires was set for November 1, 1980, following a meeting of association presidents who assisted with the tabulation, the presentations, and the initial interpretations during October.

During November and December, the results from the questionnaire were tabulated and prepared for reporting in final form. These results are included and discussed in the body of this report. The numbers responding in each of the sample groups are as follows:

Elementary Teachers (CESI Leadership)	60
Secondary Teachers (NSTA Leadership)	72
Supervisors (NSSA Leadership)	68
Teacher Educators (AETS Leadership)	77
Researchers (NARST Leadership)	75

Aside from knowing which group was responding (by a color coding scheme), the questionnaires were returned anonymously for study and analysis. Therefore, except for special notes included with several questionnaires, there was no way of checking who had responded and who had not. Several of the "reminder" letters were of necessity "thank you" letters as well, since correspondence was directed each time to all five hundred persons.

The working paper was perhaps longer and more involved than many had expected. In addition, the questionnaire was long (nine pages) and included 46 open-ended questions. Further, many who agreed to be involved may have assumed that they would have the materials earlier, thereby enabling them to complete the task when personal schedules were more favorable. Nonetheless. the number responding was significant, though less than the Association presidents had anticipated.

The body of this report represents the four divisions of the working paper: A) Introduction, B) The Aims of Science Teaching, C) The Present Conditions of Science Teaching, and D) Recommendations of the Coming Years. Each section includes a report of each question included as a part of the questionnaire (Appendix B). Hence, the study of the "Introduction" is based on information from two questions, the "Aims of Science Teaching" section on information from four questions, the "Present Structure of Science Teaching" section on information from ten questions, and "Recommendations for the Coming Years" section on information from twenty-five questions. For each question there is a graph displaying the general rating for the item and a corresponding table with the specific percentages in each study sample giving such a rating. There is also a report of a synthesis of the open-ended comments provided following each question. These comments have been classified as follows:

Basically Agree (simply restate information in the question and report "OK" or "Agree" or "Right On")

Agree and Add Insights (Agree but add an idea, enlarge the meaning, provide an added dimension)
Agree with Exception(s) (Agree but include qualifiers, often "Yes, but...," include exceptions)
Disagree (categorically disagree with the idea in the paper and/or the questionnaire)

Attempts are made by the Research Committee and research analysts to summarize the comments included in the last three categories. Tables (listings) are thus included following each graph with a tabulation of the open-ended comments which provide the ideas and an indication of their frequencies for each of the five sample groups. These are included in three tables - 1) an attempt to report the added ideas proposed by those who basically agreed with the positions in the paper (and/or the questionnaire), 2) those who agreed but had exceptions or partial disagreement, and 3) those who disagreed completely with various positions advanced. An attempt is made in the narrative to note trends, differences, and meaningful comparisons.

Each of the four sections of the working paper ends with a general statement of reaction concerning the particular section. These have been tabulated as a summary to each of the four sections of the report. In this case the comments were classified into three categories, namely Excellent, Satisfactory, and Disappointing. In some cases a ranking was requested concerning the various points in the original paper; these rankings are reported as part of the summary. All respondents were also asked for specific points of omission and/or diagreement concerning each of these sections. These lists have been tabulated and reported for each of the five sample groups with the summaries of each of the four sections.

All of the original completed questionnaires have been retained for further analysis; typed versions of all open-ended responses have also been prepared for those interested in the complete statements. Only the tabulated and generalized responses are included with this report. All responses were rated by four research analysts. The inter-rater reliability was above the 90 percent level. It was generally easy to identify disagreement and to identify general agreement with exceptions. The major discrepancies fell between those comments judged as "agree" with merely a restatement of the position espoused in the paper or the questionnaire and those responses judged to have added a dimension to the idea advanced. Some of the differences in these two categories may be apparent as one reads the ideas judged for inclusion as "added dimensions". These two categories of agreement are included in the first two parts for each graph concerned with the open-ended responses.

II. Review of Working Paper

This section of the report is divided into four major sections - each an analysis of specific positions taken by the authors of the working paper. The sections correspond to the four major sections of the original paper. The major part of each section is a presentation of ratings, opinions, and qualifications provided by the professionals who responded with information as a part of the five leadership groups agreeing to assist with the effort.

A. Analysis of Introduction Section

The working paper began with the statement that any analysis of goals, priorities, and achievement in science education must begin with recognition that such teaching occurs in an educational must begin with recognition that such teaching occurs in an educational system within a larger society. The authors comment upon the drastic changes that have occurred in our society within a very short period of time. The degree and the rate of societal change are of such magnitude that they were used as a framework for the entire effort. Well over half of the introduction included specific examples of the change in family structure and other changes that illustrate the current societal revolution in the United States.

The respondents in this study were asked to comment on two statements concerning the introduction and to react generally to that section while elaborating points of disagreement. The results of this assessment are reported in a series of graphs and tables for each of the two items and the summary question. Table and Graph A 1.1 provide information from the five respondent groups concerning the issue of the appropriateness of using the interdependence of society and science teaching as a point of departure for the paper. Graph and Table A 1.2 indicate the results of a categorization of individual comments regarding this appropriateness. Tables A 1.3, A 1.4, and A 1.5 are tabulations of the responses which add insights (while agreeing to the statement), identify specific exceptions to the statement while basically agreeing with it, and report fundamental disagreement with the statement, respectively.

In reviewing Tables A 1.1 through A 1.5 the following generalizations can be made. There is widespread (80 percent) agreement among the secondary teacher, supervisor, teacher educator, and researcher groups that the interdependence of society and science teaching is a point of departure for discussion of goals, priorities, and achievements. Only slightly over half of the elementary teachers who responded held this interdependence as important for such a framework for discussion. It is interesting to note that only 5 percent of the secondary teachers found any disagreement with the statement.

When the open-ended responses are tabulated, many interesting responses are noted. Generally there are no major differences among the five groups concerning the basic agreement with the importance of the science-society interface in reviewing the accomplishments and needs of science teaching. There is concern for too rapid and too complete a departure from the teaching of science in a more traditional sense. There is concern that some of the societal and family problems were emphasized too much as a major focus for science education. It would be difficult, however, to characterize each of the five groups based upon the group responses for each category used for reporting purposes.

Table A 1.5, which summarizes the comments when there was disagreement, was of interest because of the significant difference among the groups and group reactions based on the rating scale (A 1.1). Although 16 percent of the researchers disagreed with the position, not a single one of these persons made a comment which would elaborate upon the basis for the negative position. By contrast, the elementary teachers, where nearly a third of the sample disagreed with the statement, were more generous with specific comments. Those disagreeing tended to feel that science in such a societal context was too abstract for most students at the elementary level. Some felt that the basic concepts and processes of science were more important for elementary students than the societal setting and influences which produced them.

The second item on the study instrument indicated that societal problems should provide the most significant influence on science teaching for the 80's. This statement arose from the introductory statements that suggested the paramount position of such issues for the whole of science education.

Table and Graph A 2.1 make possible some interesting comparisons among the groups and within the same groups when the respective responses to the preceding question (regarding the interdependence of society and science teaching as a point of departure) are compared with the position reported in A 2.1. In this case approximately half of the elementary teachers, secondary teachers, supervisors, and teacher educators agree that such a focus should be the most important influence; nearly two-thirds of the researchers agree. The disagreements are nearly uniform on this issue with about a third disagreeing with such a position. Such a rating was consistent for the elementary teacher sample but more than doubled for the other four groups.

The analyses of the comments are again revealing (Tables A 2.3, A 2.4, and A 2.5). The comments which add dimensions to the basic positions are generally non-specific to responding groups. Similarly, the respondents who agree with some one or more exceptions also are non-group specific. Many in all five groups were concerned with societal problems being defined as "the most significant influence." Several would have been more comfortable with the position that such problems are one important influence.

The comments from respondents who disagree that societal problems should provide the most important influence in science teaching for the 80's are of interest. In this instance the elementary teacher group, with over one-third expressing disagreement (similar proportion to the other four groups), did not provide a single comment explaining such disagreement. Also of interest was the great number of teacher educators who chose to make comments concerning their disagreements with the position -- nearly twice as many as any of the other groups and two-thirds of all who checked "disagree" on the rating form. Many of the comments concerning disagreements indicate perceptions of other more important influences on science teaching for the 80's. Some of these suggest a rather static definition of and a rather traditional two dimensional view of its features, i.e. content and process. It is probably important to note the major differences in the levels of disagreement from the statements of concern for item A 1.1. The greater disagreement for the position advanced in A 2.1 is concerned with the designation of societal problems as "the most significant" influence and the belief that such a focus would mean less time with more traditional topics and processes.

Table and Graph A 3.1 include ratings of the five groups concerning general reactions to the introduction. It can be seen that there are few major differences among the groups with respect to such general reactions. Thirty to forty-five percent of the respondents in the five groups rated the introduction as excellent. Only 30 percent of the teacher educators rated it as excellent while 45 percent of the elementary teachers (in spite of the lower ratings they gave to the two questions regarding the content), the secondary teachers, and researchers rated it excellent. Of the respondents, fewer secondary teachers were disappointed (only 15 percent) with the introduction than were the teacher educators, among whom 31 percent expressed disappointment.

When the comments concerning disagreements are analyzed (Table A 3.2) some of the specific items of disagreement surface again. Many of these focus upon a narrow and a historical view of science, the science curriculum, and science teaching. There is also a general fear of change, of dilution, of the unknown reflected in the comments for a subgroup of each of the five samples. The teacher educators far out-number other groups in terms of the number of disagreeing statements as well as the number of individuals in the sample making the statements.

Except for the teacher educators, where the number of respondents rating the introduction as excellent is lower (by 15 percent when compared to researchers and both teacher groups) and the number rating the section as disappointing is higher (by 50 percent over the two teacher groups), the general reaction to the introduction is very positive. With 80 percent of the teacher groups and the researchers as well as about 70 percent of the supervisors and teacher educators rating the section as satisfactory or excellent, one must conclude that the introduction (with some notable exceptions) has been successful in meeting the objectives of the authors. The focus of science education for the 80's upon the science-society interface is established and so identified by the leadership in the profession.

A 1. INTERDEPENDENCE OF SOCIETY AND SCIENCE TEACHING AS A POINT OF DEPARTURE

TABLE A 1.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	54	84	78	80	79
disagree	31	5	12	4	16
neutral	15	11	10	16	5

GRAPH A 1.1 Graphic Presentation of Respondent Ratings

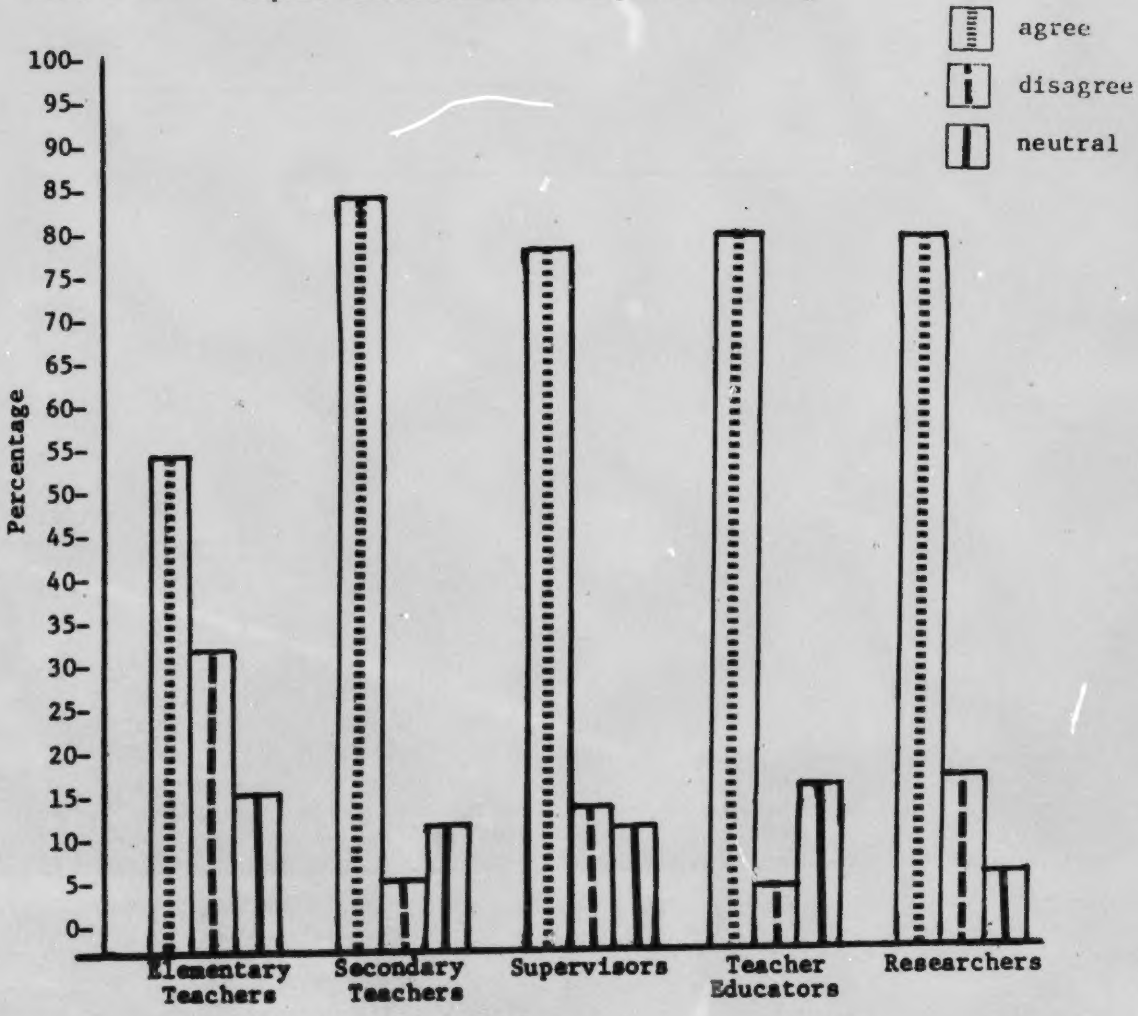
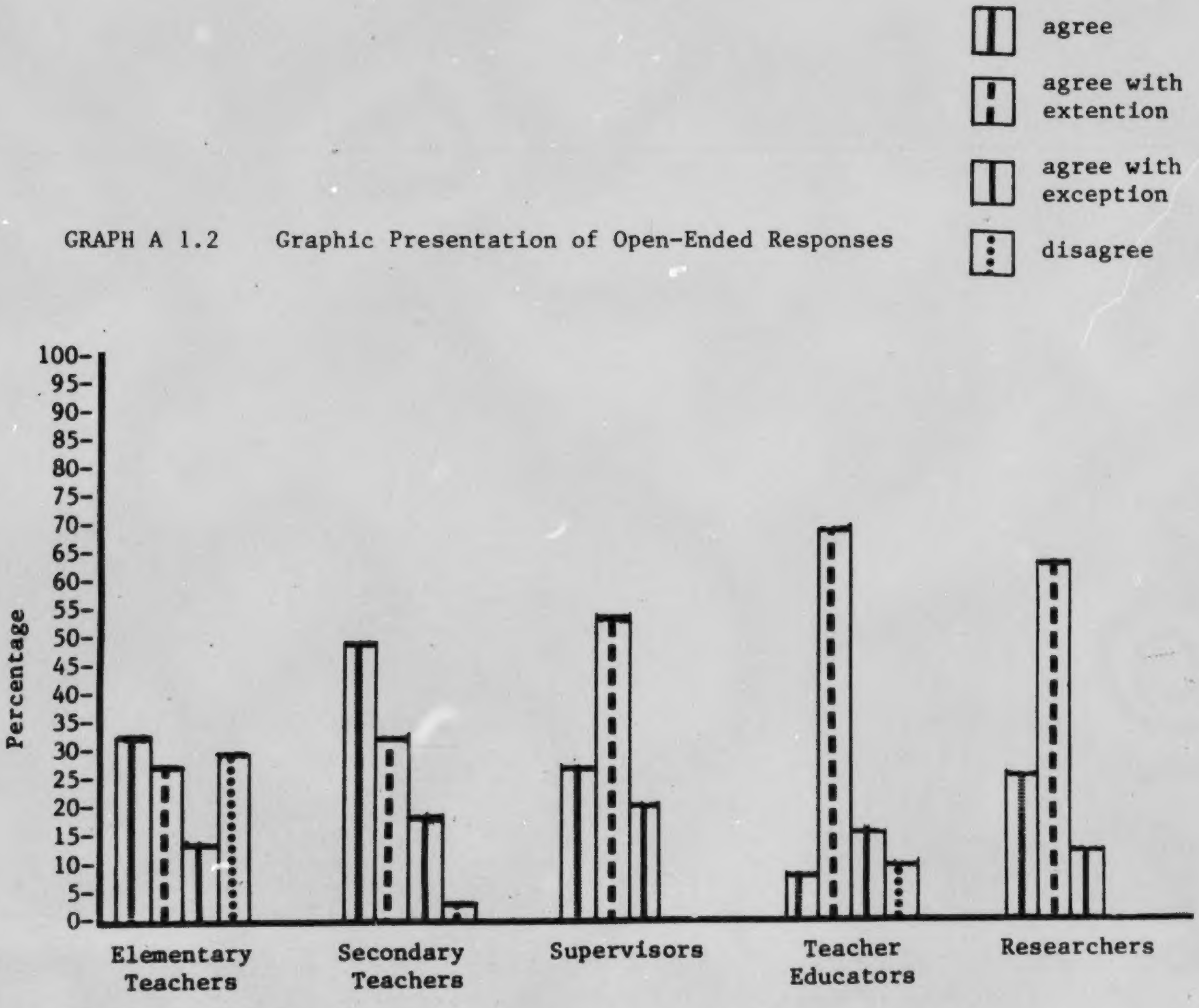


TABLE A 1.2 Categorization of Open-Ended Responses*

Percentage

	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	32	49	26	7	25
agree with extention	26	31	54	69	63
agree with exception	13	18	20	15	12
disagree	29	2	0	9	0

GRAPH A 1.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(38) (66) (59) (67) (65)

TABLE A 1.3 Tabulation of Open-Ended Responses Which Extend Position

Group	N	Summary of Responses	F
Elementary Teachers	10	Can not consider whole child outside science/society	1
		Societal issues can be tremendously important for motivation	2
		The effects of science/technology on living is basic	2
		A new framework for evaluating current science teaching is needed	1
		"Man's Survival" can provide linkage for science and social science	2
		The outside world as it really is should be a focus for school science	1
		The use of science in daily living is an example of the interdependence	1
Secondary Teachers	29	Science education must provide reason and desire to solve problems	3
		Scientific literacy for all is primary goal of science instruction	6
		Tofler's Future Shock is a reality	2
		This helps make science a basic	4
		This necessitates consideration of moral issues	3
		Technology needs more consideration	6
		Emphasis on how science and society are related is needed	5
Supervisors	32	More emphasis needed on stability of science - to offset other problems; science is fulcrum of society	7
		Need more leadership in dealing with scientists as well as society	5
		Need to relate crisis in classroom to broader ills of society	7
		Scientific thinking is way of survival in society	4
		This axis of concern puts science in control position for whole school program	2
		Science-Society interface may be organizer for emerging goals of science education	7
Teacher Educators	46	Need funds to support curriculum development with such a focus	7
		Science and society have been deeply entwined for past 40 years and this should be reflected in school practice	10
		Need to work on making science more responsive to society	4
		Science teaching has no base outside a societal context	8
		Easier to see student participation in real world with such a focus	3
		Consensus on current problems exists and therefore a good base for school science	4

N = Number of Responses
F = Frequency of Responses

TABLE A 1.3 Tabulation of Open-Ended Responses Which Extend Position (continued)

Group	N	Summary of Responses	F
Teacher Educators continued		Should not only be a starting point but an idea to weave throughout	3
		Need for general scientific literacy increases as use of science/technology in society increases	7
Researchers	41	Too few schools and teachers are involved with such approaches to school science	5
		Development of scientifically literate citizenry is primary goal of science teaching	7
		Major problems today are related to science/technology	3
		Television and computer technology should receive more attention	3
		As attempts are made to integrate science, new attempts to integrate science with other disciplines must be made	4
		External forces upon science education must be recognized, studied, and acted upon	4
		Such an analysis helps define science education as a profession	3
		Science has been treated as a non human activity too long	3
		Science/Society interface provide base for considering accomplishment and needs of science education	5
		Old organizers for course of the 60's gave good rationale for producing scientists/engineers; but without broader context programs have no use for general public	4

N = Number of Responses
F = Frequency of Responses

TABLE A 1.4 Tabulation of Open-Ended Responses Which Take Exception to Position

Group	N	Summary of Responses	F
Elementary Teachers	5	The problems associated with family and community are not major ones	2
		Other factors have been shown to be as effective in impacting achievement	2
		Effects of society on technology all but ignored	1
Secondary Teachers	13	Danger of science education trying to do too much	2
		Today's problems not fault of science and science teaching	2
		"Interdependence" as a concept needs more emphasis emphasis	1
		Must consider ability and attitudes of students	2
		Must not become intimidated by society	2
		There are other valid organizers	3
		Many of family/youth problems can't be solved by school	1
Supervisors	12	Emphasis on family problems-not societal ones	3
		No new goals to deal with ills of society	1
		Need to keep up with reality of our social problems	1
		Do not forget needs of individual and nature of learner	1
		No concern for economy, energy, or population	1
		Do not forget basic science, especially for talented	1
		Must also preserve nature of subject itself	2
		Need to be concerned with range of what we can do	1
		Problems of motivation and teacher's specialization in training	1
Teacher	10	Can not forget student needs	2
		Not the only good organizer	1
		Need more information on interdependence and less report on current problems	1
		Many other problems that exert influence	2
		Seems more like reason for failure of current courses	1
		Society needs to be viewed in its entirety	1
		Must retain some programs for preparing future scientists	2
Researchers	8	Overemphasis on problems of youth	1
		Development of problem solving skills is basic	1
		No interdependence shown	1
		Should be emphasis throughout, including end point of study	1

N = Number of Responses
F = Frequency of Responses

TABLE A 1.4 Tabulation of Open-Ended Responses Which Take Exception to Position (continued)

Group	N	Summary of Responses	F
Researchers continued		Teacher experience, teaching materials, and tradition make goals difficult to attain	1
		Do not forget economics and technology	1
		Do not forget the individual/individual needs	1
		Need to remember importance of school climate or learning and its relationship to broader societal influences	1

43

N = Number of Responses
F = Frequency of Responses

TABLE A 1.5 Tabulation of Open-Ended Responses Which Disagree With Position

Group	N	Summary of Responses	F
Elementary Teachers	11	Too abstract for elementary	6
		God is starting point	2
		Basic knowledge must come first	3
Secondary Teachers	1	Statement is vague/esoteric	1
Supervisors	0		
Teacher Educators	6	Too sophisticated/abstract for most	1
		Question the existence of an interdependence	1
		Societal needs change too quickly to be valuable organizer	1
		Does not focus enough on why all should be the starting point	1
		Basic content of science must be the starting point	1
		Science/Society not central—not a starting point	1
Researchers	0		

N = Number of Responses
F = Frequency of Responses

A 2. SOCIETAL PROBLEMS SHOULD PROVIDE THE MOST SIGNIFICANT INFLUENCES ON SCIENCE TEACHING FOR THE 80's

TABLE A 2.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	52	46	53	52	63
disagree	34	34	30	32	28
neutral	14	20	17	16	9

GRAPH A 2.1 Graphic Presentation of Respondent Ratings

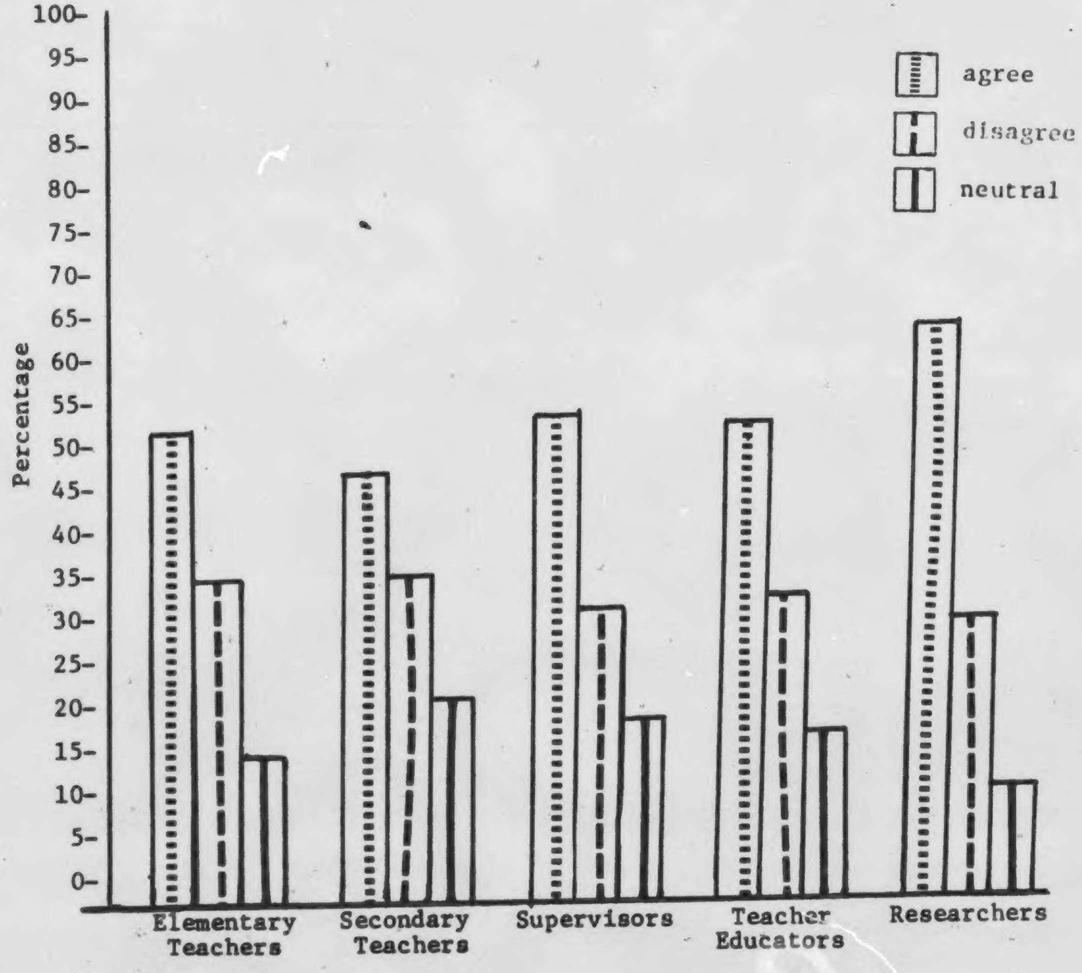
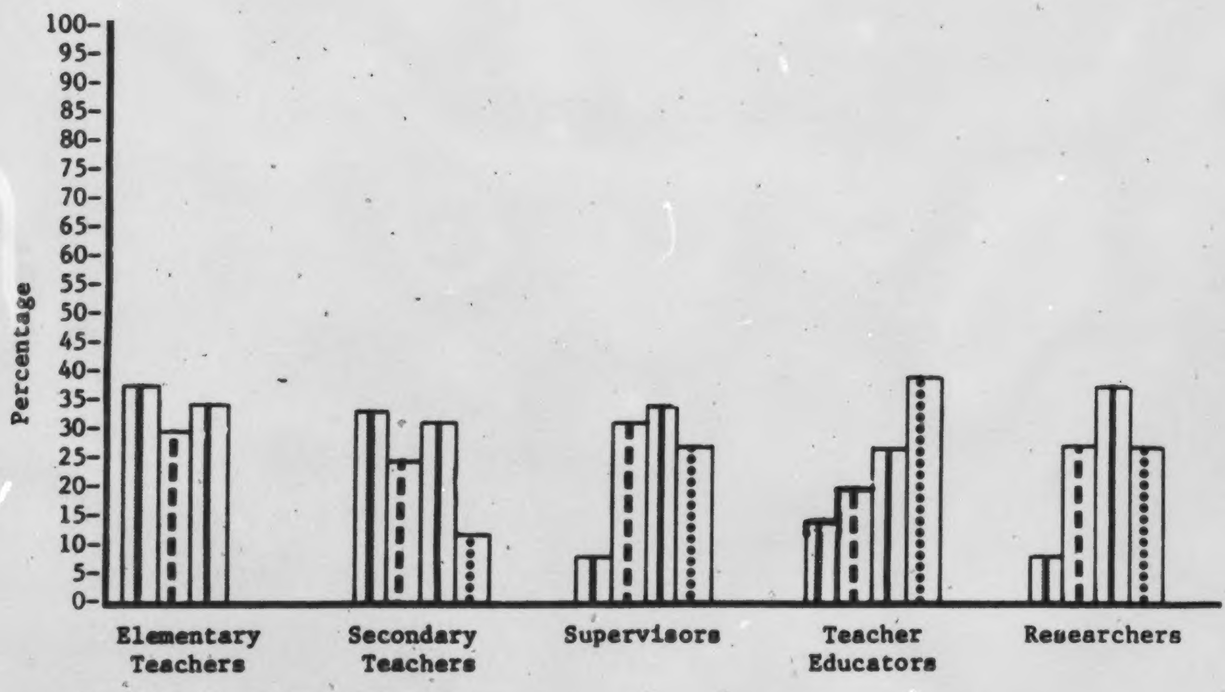


TABLE A 2.2 Categorization of Open-Ended Responses*

Percentages	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	37	33	8	14	8
agree with extention	29	24	31	20	27
agree with exception	34	31	34	27	38
disagree	0	12	27	39	27

GRAPH A 2.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
(35)	(55)	(48)	(56)	(48)

TABLE A 2.3 Tabulation of Open-Ended Responses Which Extend Position

Group	N	Summary of Responses	F
Elementary Teachers	10	Rapidity of change is exemplified in all dimensions	2
		Good preparation for future	1
		Excellent for student motivation	2
		This trend recognizes out-of-school influences on students	2
		The importance of God is easier to see	1
		More than national policy students and school leaders	1
		If "influence" used in some sense	1
Secondary Teachers	13	Population, food, energy, etc., all provide basis for school science	3
		Projected changes provide excitement	1
		This implies coping, which is extremely important	2
		This provides use of science	2
		This makes individualization easier	1
		Such a force provides a more rational reason for existing	2
		Current problems good preparation for future	2
Supervisors	15	International concerns are vital for the future	2
		Health is good example	2
		Such problems provide stimulation for change and for science discoveries	3
		Such a focus answers the students' "so what?"	2
		Energy and environment concerns are central to our existence	2
		Future problems also provide an important focus	3
		"Will" is a better verb than "should"	1
Teacher Educators	11	Values and concerns should also be included	4
		Need to be sure there is a future dimension	2
		Attitudes and skills will help resolve the problems	4
		Important that science is meaningful and useful	2
Researchers	13	Existing programs should be adjusted to reflect this focus	2
		This focus is great for student motivation	2
		Such a focus is closer to technological advances that will affect the lives of everyone	3
		Such a focus can provide help for explanations of natural phenomena	1
		This provides a way of seeing science	1
		This keeps science current and meaningful; need to specify the problems	3
		This does not limit traditional science - just a new organizer	1

47

N = Number of Respondents
F = Frequency of Responses

TABLE A 2.4 Tabulation of Open-Ended Responses Which Take Exception to Position

Group	N	Summary of Responses	F
Elementary Teachers	12	Question "top" priority	2
		If focus on attitudes of people toward science	1
		Should include all social sciences, not just social problems	1
		Do notforget basic concepts	2
		Should not forget the plain wonder of science	1
		Probably varies in significance across grade levels	1
		Should specify which social problems	1
		Science trends, changes, and discoveries are also important	1
		If this includes "survival skills"	2
Secondary Teachers	17	Other problems important; i.e., maturity of student, teachers, environment, learning	2
		But lower levels should focus on skills	2
		If we don't forget technology	3
		If we can fight current basics syndrome	1
		We must not forget 2000 in midst of concern for 80's	1
		Need to be sure trends not short-sighted fads	1
		Limited list of issues in paper	2
		If we limit the issues to those science can impact	1
		If intertwined with good liberal arts base	1
		New knowledge of learning must be used too	1
		But subject matter should not be lost	2
Supervisors	16	Personal needs are also a strong influence	2
		Whole of society should be reflected, not just problems	2
		Content and process also are important	2
		School can't solve them	1
		Technological problems also important	2
		Need to specify which ones	1
		Basic content information is essential before they can be considered	2
		Real focus should be beyond 1980	2
		Curriculum should not be "one-sided"	1
		Should be a focus on anticipated problems as well	1
Teacher Educators	15	But impact of problems is negative	2
		Economic problems are great	2
		"All" societal problems is too broad	3
		Only negative relation is emphasized in paper	1
		Applications of science are not most significant aspect of science education	2
		But most crucial problems not included	1
		Most significant is too strong	1
		Balance in school science must be sought	3

N = Number of Respondents
F = Frequency of Responses

TABLE A 2.4 Tabulation of Open-Ended Responses Which Take Exception to Position (continued)

Group	N	Summary of Responses	F
Researchers	18	If tests change too; i.e., accountability reports	1
		There are many "most important" influences	1
		Need to be aware of spectrum of learners	2
		Issues in paper are not prime ones	1
		Maybe there is a deeper reflection needed; e.g., "why" the problems exist	1
		Not only to solve problems but to understand humans and their world	2
		The problems identified are already out-of-date	1
		Inquiry can not solve these problems	2
		They do not change nature of science	2
		Place of individual seems lost	1
		Only a start - really need focus of future	1
		As long as cure not goal of science	1
		Question nature of class period, unit, organization of course for a year	2

N = Number of Respondents
F = Frequency of Responses

TABLE A 2.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Secondary Teachers	7	Other more important tasks	1
		Science as knowledge more important	2
		This would ignore standards	1
		Students need to know facts of science more	2
		Basic concepts first	1
Supervisors	13	Problem solving is most important	4
		Science content is most important	2
		Such problems have no importance without science background	3
		Disseminating information is a must, before everything else	1
		Budget problems are far more critical	2
		Science must impact society, not the reverse	1
Teacher Educators	22	Most students too immature for such a focus	3
		Content and process more important	5
		Problems too short-lived	2
		Societal problems "too big" for science to handle	4
		Traditions are (and should be) major influence	2
		Such problems cannot be solved, so bad to use to illustrate science	1
		Such a focus would make science curricula like a yo-yo	2
		Since problems change, they cannot be a base	3
Researchers	13	Should not provide "direction" for what is taught	1
		Science should be taught as "science"	2
		Society is just one of many influences	1
		Nature of science is the most important	3
		Total spectrum more important than society alone	1
		Issues change too fast to provide base for curriculum	1
		This is not thrust of science education	1
		Goals for science education must be more stable	2
		This is negative base for science teaching	1

N = Number of Respondents
F = Frequency of Responses

A 3. GENERAL REACTION TO "INTRODUCTION"

TABLE A 3.1 Categorization of Open-Ended Responses*

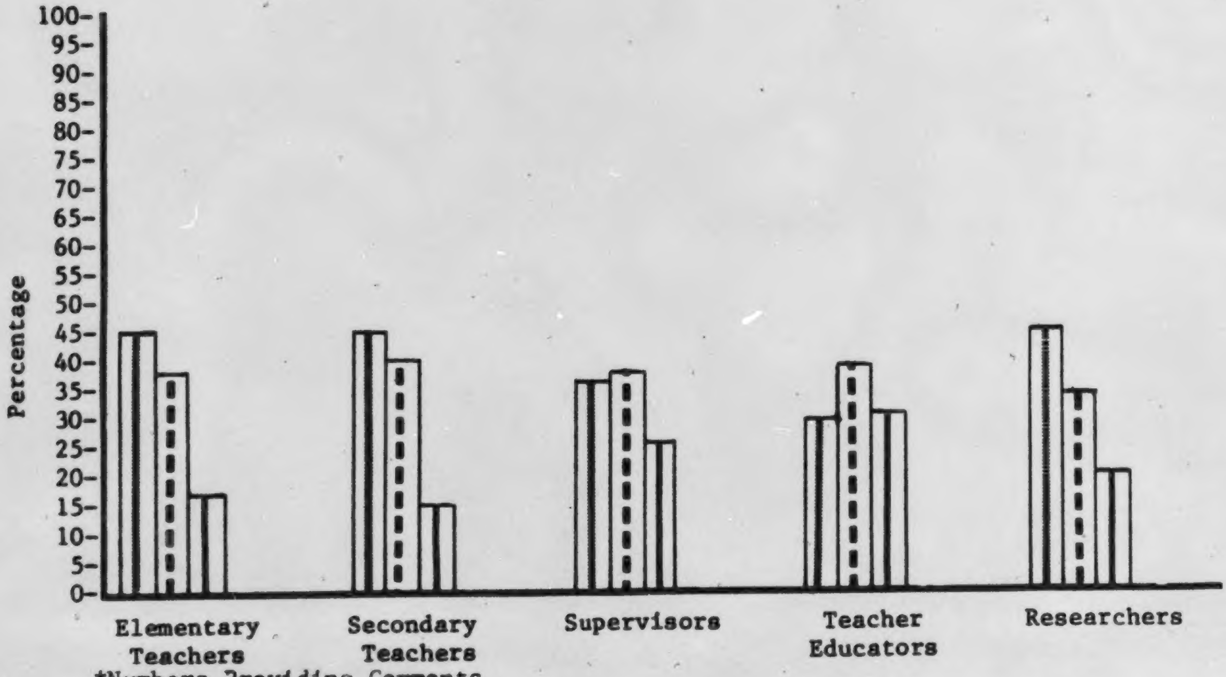
Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
excellent	45	45	36	30	45
satisfactory	38	40	38	39	34
disappointing	17	15	26	31	21

▥ excellent

▤ satisfactory

▯ disappointing

GRAPH A 3.1 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(53)	(58)	(55)	(71)	(47)

TABLE A 3.2 Tabulation of Open-Ended Responses Listing the Points of Disagreement

Group	N	Summary of Responses	F
Elementary Teachers	9	Should focus on attitudes toward science and scientists	2
		Major concerns are inflation and declining enrollments	2
		Too negative	2
		Expecting too much from science teaching	2
		More appropriate for social sciences	1
Secondary Teachers	9	Missed point of problem, i.e. poor science teachers and no new ones entering ranks	2
		Science teachers can not assume responsibility for all societal problems	2
		Rapid change is a proper focus - not social problems	2
		This section seems to be a search for a scapegoat	1
		Such a focus for school science may be a detriment to future science	1
		Many of the problems outlined should be left to religion	1
Supervisors	14	Academic science is the real need for science for the 80's	2
		The problems mentioned simply are not the primary conditions affecting schools	2
		Science of the 60's has led the educational community: let's not retreat now	2
		More social science than science	1
		Too much emphasis on family	1
		Real problem is unqualified and uninterested teachers	1
		The student problems sound like "adult" problems - not student ones	1
		The approach suggested is non-scientific	1
		Too general; too negative	1
		The section raises more questions than warranted	1
		Looks like authors want a scapegoat	1
Teacher Educators	22	It is both vague and presumtuous; it is an alarmist picture	3
		Too little attention to declining quality of teaching	3
		Entirely too negative	2
		No concern for the way students learn	2
		Misses point of science teaching	2
		School can not affect societal problems discussed	1
		Science is not concerned with solving problems for society	1
		Science deserves legitimate place in curriculum as a discipline	1
		Omits science as human enterprise	1
		Section too dramatized	1
		Section suggests causality without evidence - too speculative and simplistic	1

N = Number of Respondents
F = Frequency of Responses

TABLE A 3.2 Tabulation of Open-Ended Responses Listing the Points of Disagreement (continued)

Group	N	Summary of Responses	F
Teacher Educators continued		Theme fits social studies - not science	1
		Authors appear to know little about genetic basis of behavior and social structures	1
		Rhetoric weak and facts inaccurate	1
		Starts with assumption science teaching bad and societal problems the result	1
Researchers	10	Problems over simplified and narrow	2
		Weak and misleading	2
		No logical relation to factors mentioned and science teaching	2
		Presents negative view of adolescents	1
		Family structure has no influence	1
		The ideas provide no suitable focus for school science	1
		Too many problems ignored	1

N = Number of Responses
F = Frequency of Responses

B. Analysis of the Aims of Science Teaching Section

The second major section of the working paper was a discussion of the aims of science teaching. The first third of the paper provided a broad historical review of the goals for science education as reported in the 1932 Thirty-First Yearbook of the National Society for the Study of Education, the Forty-Sixth Yearbook, and the Fifty-Ninth Yearbook. There seemed to be general agreement that the major ideas and the modes of reasoning needed to formulate and/or apply these ideas were the major aims of science teaching.

When the five groups comprising the study sample were asked to rate their degree of agreement with the statement that the goals for science teaching have remained stable over a forty year period, most respondents agreed. Table and Graph B 1.1 indicate the specific results of the ratings for the five groups. Over three-fourths of the secondary teachers and supervisors, two-thirds of the supervisors, three-fifths of the elementary teachers, and just over half of the researchers agreed. Significantly more of the college sample (teacher educators and researchers) disagreed with this stability of goals. Nearly a third of each the teacher education and the research groups disagreed.

The respondents were asked to indicate specific goals of science teaching for which they felt there was general agreement. Table B 1.3 is an abbreviated summary of the goal areas identified by respondents. It is interesting to note that goals centering on central concepts and the processes of science are by far the most common goals listed by individuals in all five groups. The attainment of scientific literacy is the third most common goal for the supervisor and the teacher educator groups. It is tied with the attainment of scientific attitudes for the researchers; this goal is a distant third choice among members of the elementary teacher group. Using the ideas and/or concepts of science is a common goal listed by persons in all five groups.

Another point of interest is the fact that all goals mentioned by elementary teachers, secondary teachers, and supervisors could be classified into five areas: concepts, processes, attitudes, scientific literacy, and application. These five areas were also the major areas for teacher educators and researchers as well. However, additional goal areas were included by these collegiate groups. The areas included career awareness, science/society interaction, logical thinking/decision making, and the dogmas which emerge around science.

The working paper used the 1964 NSTA Theory into Action and the 1971 "Science for the Seventies" paper as examples of goals and directions for science education in the immediate past. The eleven points defining scientific literacy were included in this paper, presumably because of their relevance a decade later and because they define "scientific literacy," a major goal of science teaching.

The research sample was asked to comment upon the 1964 and 1971 NSTA statements as accurate descriptions of scientific literacy for the 80's. Table and Graph B 2.1 display the results of this inquiry. About three-fourths of the elementary teachers, secondary teachers, supervisors, and teacher educators agree that the descriptions are as accurate as they were when they were written. Slightly over one-half of the researchers agree, with a third disagreeing with the current accuracy and completeness of the statement for the 80's.

The results of the open invitation to listing "new features" of a scientifically literate person for the 80's produced interesting results which are reported in Table B 2.3. The number of such new features suggested by all groups is surprising when one considers the degree of agreement concerning the adequacy of the description of ten years ago. The elementary teacher group suggested eighteen new descriptions, the secondary teacher group thirty-two, the supervisors twenty-three, the teacher educators twenty-seven, and the researchers thirty. This large number of suggestions from researchers is not unexpected in view of their more critical view of the 1971 description.

Common new descriptions for a scientifically literate person of the 80's include emphasis upon such traits as decision-making, consideration of the values dimension of science, concern for the future, the human aspects of science, the whole complex of science-technology-society interactions, career awareness, and the interrelatedness of science to all other human enterprises.

The working paper moves next to unique principles and aims for science teaching for the 80's. It stresses the importance of a science education for everyone. It suggests the need for new aims based upon changing social conditions, different national priorities than ever before present, and new information from research workers. The five respondent groups were asked to react to the proposition that the goals in science education are in a period of significant transition as the 80's begin.

The results are reported in Table and Graph B 3.1. It can be noted that over two-thirds of the supervisors and the researchers agree, as do over half of the two teacher groups. Of special interest is the fact that only 40 percent of the teacher educators agree with an even larger percentage disagreeing. One might assume that persons in charge of the preparation of new teachers would be closer to change, to curriculum needs, to instructional goals -- certainly to a greater degree than that reported by practitioners.

The groups were asked to describe causes and to indicate new directions. Essentially all groups identified the causes for change as described in the working paper and summarized above. More interesting results, as well as more responses per se, were reported as new directions for goals of science teaching. Several persons in each of the five groups reported "no real change" as a comment in this section. The numbers for each group were: elementary teachers-three, secondary teachers-seven, supervisors-nine, teacher educators-thirteen, and researchers-four. The greater number of teacher educators and supervisors who reported "no change" is again of special interest.

Summaries and frequency counts for each of the five sample groups can be found in Table B 3.2. By far the most common new direction is that concerned with the science-technology-society interface. It is the only "direction" mentioned in double digits for four of the five sample groups. (No single direction was mentioned by elementary teachers over five times). The similarity of categories to the preceding description of the new features of scientific literacy is striking. The summary categories used for Table B 2.2 could be used here as well.

The "aims" section ends with a paragraph emphasizing the importance of change in science and the need for continual reassessment of goals for teaching science. Because curricula and teaching strategies should be based upon goals, it can be seen that evolving and changing goals necessitate many other changes.

The research sample was asked to rate the validity of the position that change in goals, curricula, and teaching strategies is inherent to science education. Table and Graph B 4.1 provides the results. All groups tend to agree with the lowest agreement among elementary teachers (70%) and the highest among researchers (82%). Although the number disagreeing is low, it is interesting to note that more disagreement is reported by teacher educators than for other groups.

Table and Graph B 4.2 provide information concerning a categorization of the open comments regarding the expectation for changes in goals, curricula, and teaching strategies in science education. More responses were provided by teacher educators with fewer agree statements and more agree with exceptions and disagreeing statements. It seems that teacher educators tend to be less inclined to change, less comfortable with it, and more convinced of the rightness of their pedagogy than are other professionals in science education.

Table B 4.3 is a tabulation of the comments made by the five sample groups which tended to support and enlarge the concept that change is inherent to goals, curriculum, and teaching strategies in science education. Many relate specifically to references and/or examples found in the original working paper.

The comments of general or partial agreement but with noted exceptions are always interesting. Table B 4.4 includes a tabulation of the exceptions to the basic statement as identified by each of the five groups. The divergence of opinion among what can, what should, and what does change with respect to goals, curriculum, and teaching strategy can be explained by the differences between advocacy for change and its actual occurences by members in each group.

Table B 4.5 is a tabulation of the comments which basically disagree with the statement that change in goals, curriculum, and teaching strategy are inherent to science teaching. The comments provide a real clue to the disagreement reported in Tables B 4.1 and B 4.2. The numbers of comments disagreeing with the position are relatively small except for teacher educators. The basic tenor of the disagreements in this area seem to fall upon the false sense of change in science teaching, the relative stability of science concepts, courses, the curriculum, teaching strategies, and "published" goals.

Table and Graph B 5.1 are indications of the general reaction of the five sample groups to the "Aims of Science Teaching" section. Of greatest interest is the number of respondents in each group rating the section as "disappointing" after giving extremely high ratings to the four position statements that were chosen to exemplify the points in the working paper for the questionnaire. Apparently there is more agreement concerning specific points, i.e. aims of science teaching, than there is for the entire five pages of narrative in the paper.

The explanation for the relatively strong expression of disappointment is found in the tabulated responses reported in Table B 5.2. Although the responses are of interest in terms of discovering the basis for the individual ratings, there do not seem to be major differences among groups of respondents and/or a preponderance of items falling neatly into a few categories. The large number of comments from teacher educators is expected because of the more negative reaction to the treatment of goals they gave throughout this section. The relatively few specific comments provided by the elementary teacher group is also noteworthy.

B 1. FORTY YEARS OF AGREEMENT ON GOALS FOR SCIENCE TEACHING

TABLE B 1.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	58	74	73	66	52
disagree	20	15	17	27	32
neutral	22	11	10	7	16

GRAPH B 1.1 Graphic Presentation of Respondent Ratings

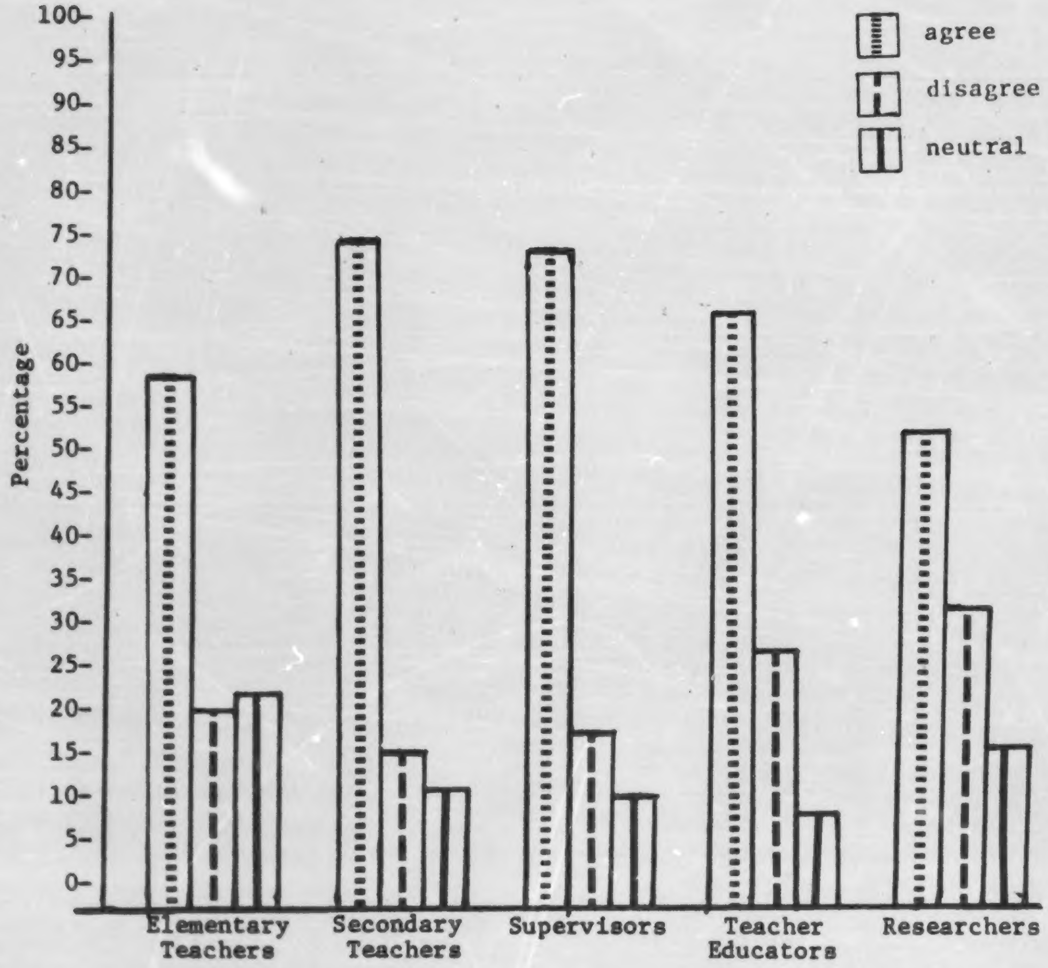
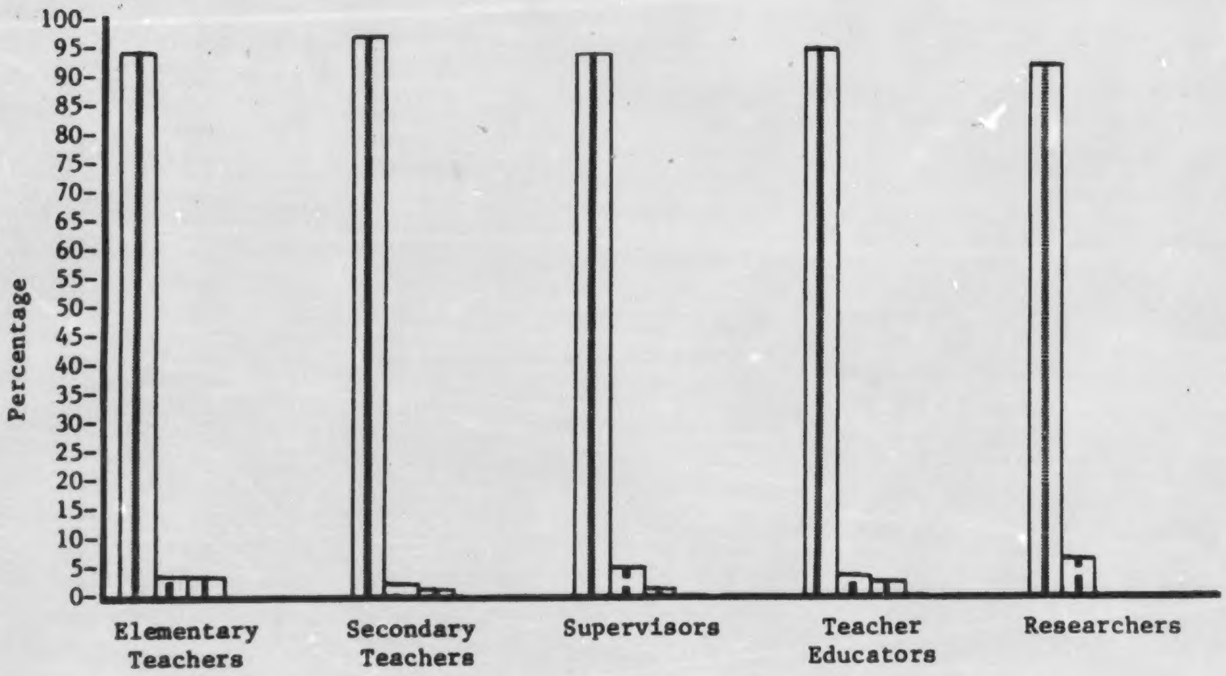


TABLE B 1.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	94	97	94	95	93
disagree	3	2	5	3	7
neutral	3	1	1	2	0

GRAPH B 1.2 Graphic Presentation of Open-Ended Responses



*Number Providing Comments

Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
46	52	50	74	55

TABLE B 1.3 Tabulation of Open-Ended Responses Which Suggest Major Goals

Group	N	Summary of Responses	F
Elementary Teachers	44	Basic concepts	22
		Processes of science	25
		"Scientific" attitude	6
		Using concepts/ideas	4
		"Scientifically" literate society	4
Secondary Teachers	50	Basic concepts	21
		Processes of science	16
		"Scientific" attitude	6
		Using concepts/ideas	5
		"Scientifically" literate society	7
Supervisors	48	Basic concepts	24
		Processes of science	16
		"Scientific" attitude	5
		Using concepts/ideas	2
		"Scientifically" literate society	14
Teacher Educators	64	Basic concepts	22
		Processes of science	22
		"Scientific" attitude	9
		Using concepts/ideas	3
		"Scientifically" literate society	13
		Career awareness	1
		Science/Society interaction	4
		Logical thinking/decision making	1
		Creativity	1
Researchers	53	Basic concepts	21
		Processes of science	21
		"Scientific" attitude	8
		Using concepts/ideas	5
		"Scientifically" literate society	8
		Career awareness	3
		Science/Society interaction	4
		Logical thinking/decision making	1
		Teaching a given dogma	2

N = Number of Respondents
F = Frequency of Responses

B 2. THE NSTA DESCRIPTION OF A SCIENTIFICALLY LITERATE PERSON CONTINUES TO BE ACCURATE

TABLE B 2.1 Result of Respondent Ratings

		Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
Percentage	agree	75	83	74	77	58
	disagree	15	7	16	13	30
	neutral	10	10	10	10	12

GRAPH B 2.1 Graphic Presentation of Respondent Ratings

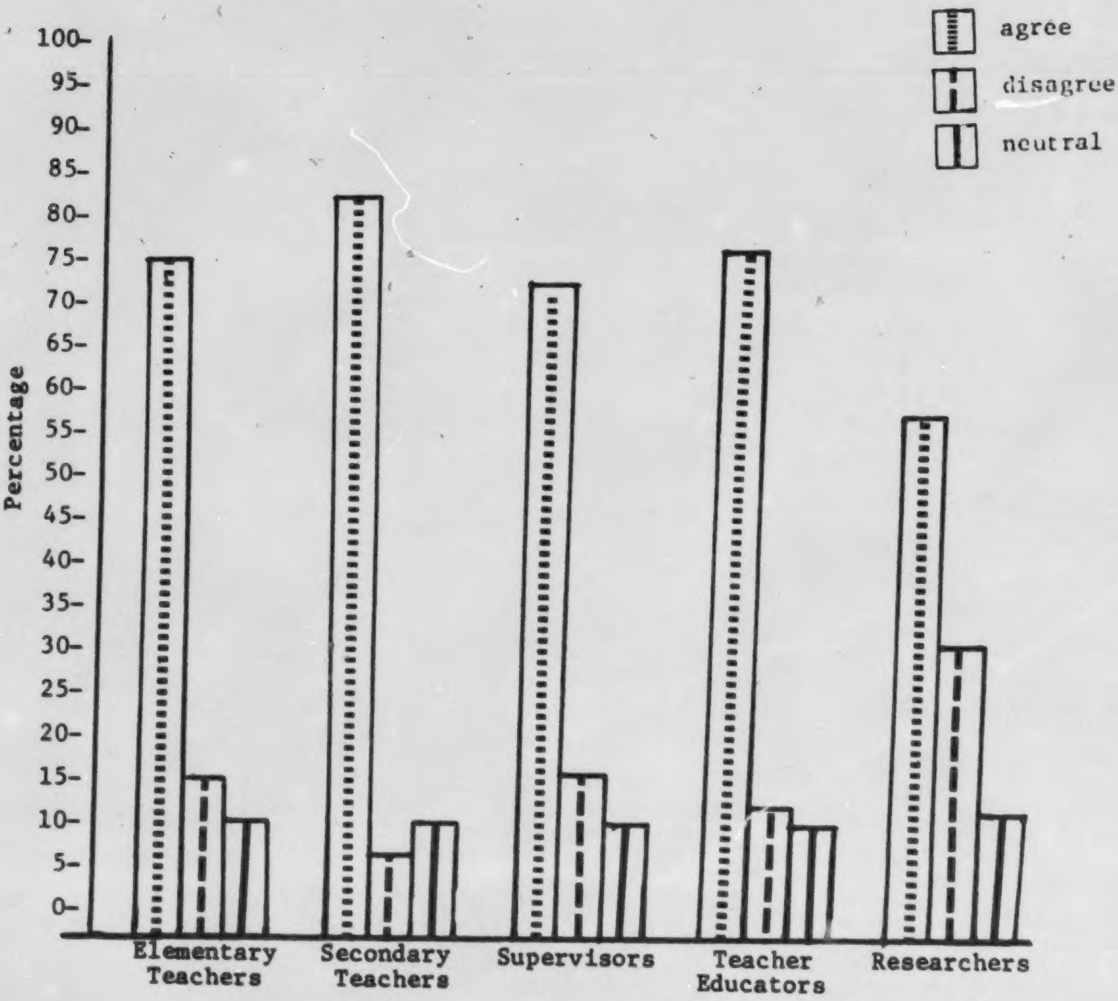
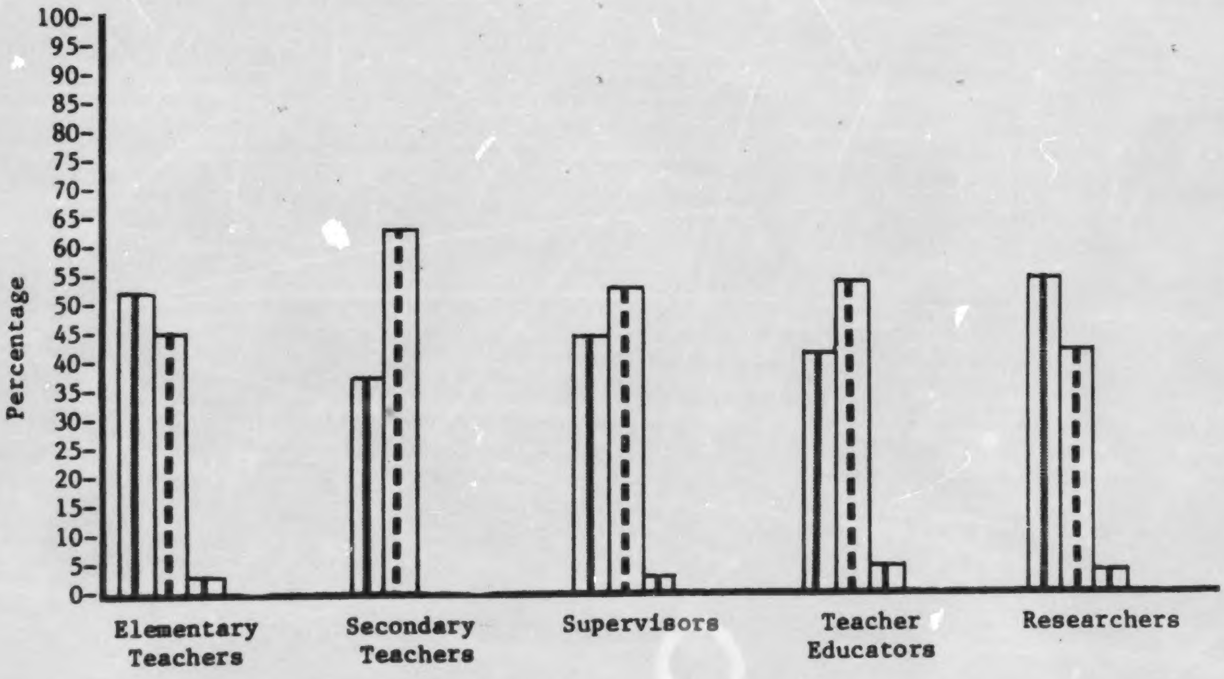


TABLE B 2.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	52	37	44	41	54
agree with extention	45	63	53	54	42
disagree	3	0	3	5	4

GRAPH B 2.2 Graphic Presentation of Open-Ended Response:



*Numbers Providing Comments

(33) (46) (36) (48) (39)

TABLE B 2.3 Tabulation of Open-Ended Responses Listing New Features Suggested

Group	N	Summary of Responses	F
Elementary Teachers	33	Science-Society Interface	7
		Technology	3
		Decision-making	3
		Morals, ethics, values	2
		Future Emphasis	1
		More Evidence of psychological goals and principles	1
		Broader view of science	1
Secondary Teachers	46	Human aspect of science	5
		Recognization of pseudo-sciences	4
		Making rational decisions	4
		Societal implications	4
		Technological considerations	3
		Ethical, moral, values component	3
		Concept of change	2
		Focus on future	2
		Interrelationships of science	2
		Economics/consumerism	1
		More communication skills	1
		Career awareness	1
Supervisors	36	Effect of technology	6
		Societal issues	5
		Personal Aspects	5
		Rational decision-making	2
		More on limitations of science	2
		Mathematics and writing skills	1
		Ethical, moral, value dimensions	1
		Career aspects	1
Teacher Educators	48	Science-society interaction	6
		Human aspects	5
		Inclusion of technology	4
		Ethical, moral, value dimensions	3
		Consumerism	2
		Future focus	2
		More personal images of scientists and sciencing	2
		Engaging in rational decision making	1
		Career implications	1
		Interrelatedness	1
Researchers	39	Science-society interaction	7
		Technology	5
		Human aspects	4
		Limitations of science	3
		More on decision-making	3
		Ethical, moral, value dimension	3
		More implications for level of development	2
		Consumerism	2

N = Number of Respondents
F = Frequency of Responses

B 3. CURRENT GOALS ARE IN PERIOD OF SIGNIFICANT TRANSITION

TABLE B 3.1 Result of Respondent Ratings

		Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
Percentage	**agree**	56	50	70	40	66
	disagree	34	32	17	44	25
	neutral	10	18	13	16	9

GRAPH B 3.1 Graphic Presentation of Respondent Ratings

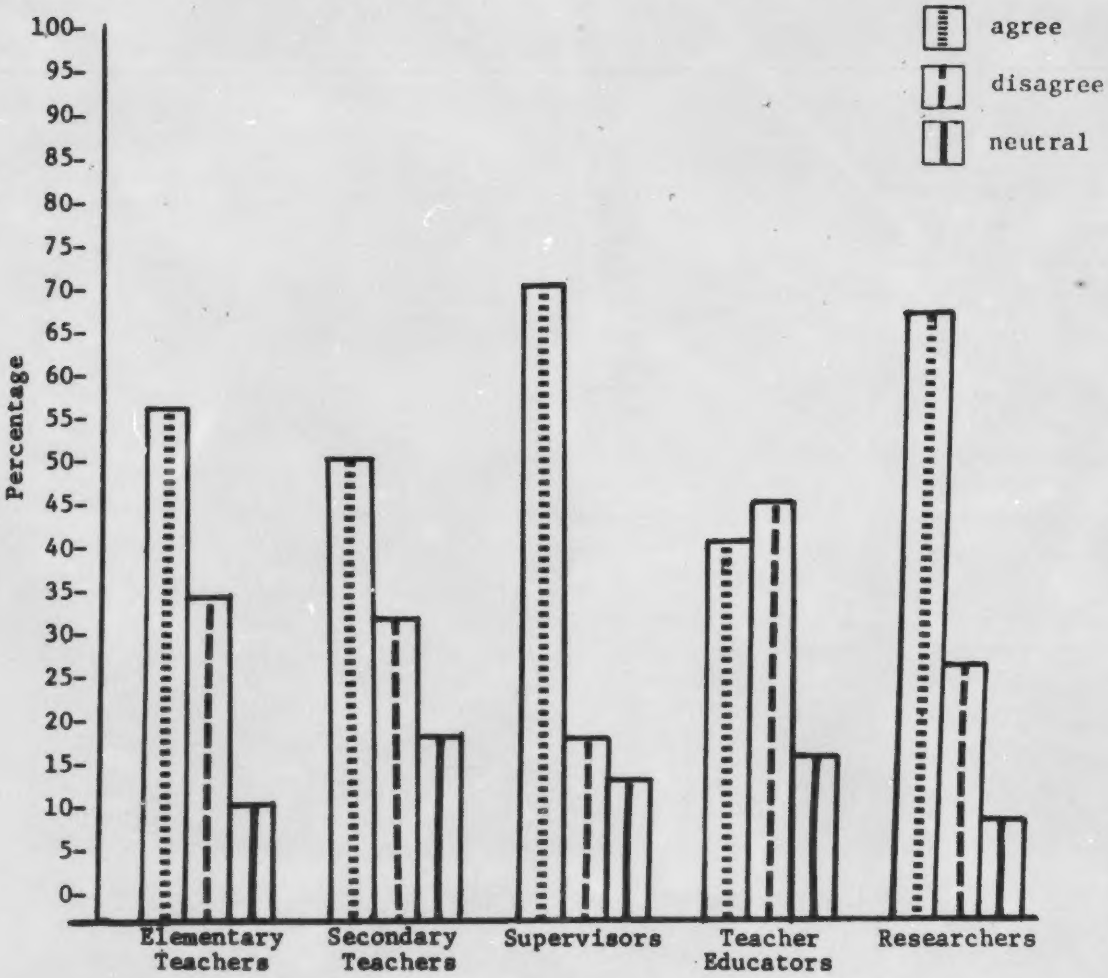


TABLE B 3.2 Tabulation of Open-Ended Comments Describing New Directions of Science Education

Group	N	Summary of Responses	F
Elementary Teachers	52	New interest in talented students	5
		Less time for science	4
		Less parental and administrative support	4
		Social issues	4
		Knowledge explosion	4
		Fewer supervisors	3
		Value dimension	2
		Teacher competency	2
		Economic problems	2
		Ideas of learning	2
		Science for all	2
		Television	2
		Reading skills	2
		Limitations of science	1
		Continuing education of all	1
		Decision-making	1
Secondary Teachers	55	Societal issues	19
		Science for all	7
		Application of learning theory	5
		Knowledge explosion	4
		Conservatism	2
		Bad economic situation	2
		Using science for living	2
		Continuing education for all	1
		Realization of limits of science	1
		Science now "more basic"	1
Supervisors	60	Societal issues	19
		Use of Science	9
		Values Dimension to science	6
		Economic problems	3
		Future-oriented	3
		Information of student mental ability	2
		Anti-intellectualism	2
		Conservatism of the times	2
		Achievement scores	1
		Science for special population	1
Teacher Educators	70	Societal issues	16
		Emphasis on use of information	7
		Conservatism	6
		Economic problems	4
		Emphasis on limitations of science	4
		Science for special populations	4
		"Our" ignorance	2
		Values dimension	2
		Needs of talented students	1
		Textbooks	1
		Use new information about learning	1

N = Number of Respondents
F = Frequency of Responses

TABLE B 3.2 Tabulation of Open-Ended Comments Describing New Directions of Science Education (continued)

Group	N	Summary of Responses	F
Researchers	42	Societal issues	12
		Science for all students	5
		Understanding of learning	3
		Disagreement among educators	2
		Use of scientific information	2
		Value dimension	2
		More real understanding of limitations of science	2
		Lack of teaching experience	1
		Lack of communication in science education circles	1
		Knowledge explosion	1
		Experience as base for science education	1

N = Number of Respondents
F = Frequency of Responses

66

B 4. CHANGES WITH RESPECT TO GOALS, CURRICULUM, AND TEACHING STRATEGIES ARE TO BE EXPECTED

TABLE B 4.1 Result of Respondent Ratings

		Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
Percentage	agree	70	74	72	76	82
	disagree	11	11	9	15	13
	neutral	19	15	19	9	5

GRAPH B 4.1 Graphic Presentation of Respondent Ratings

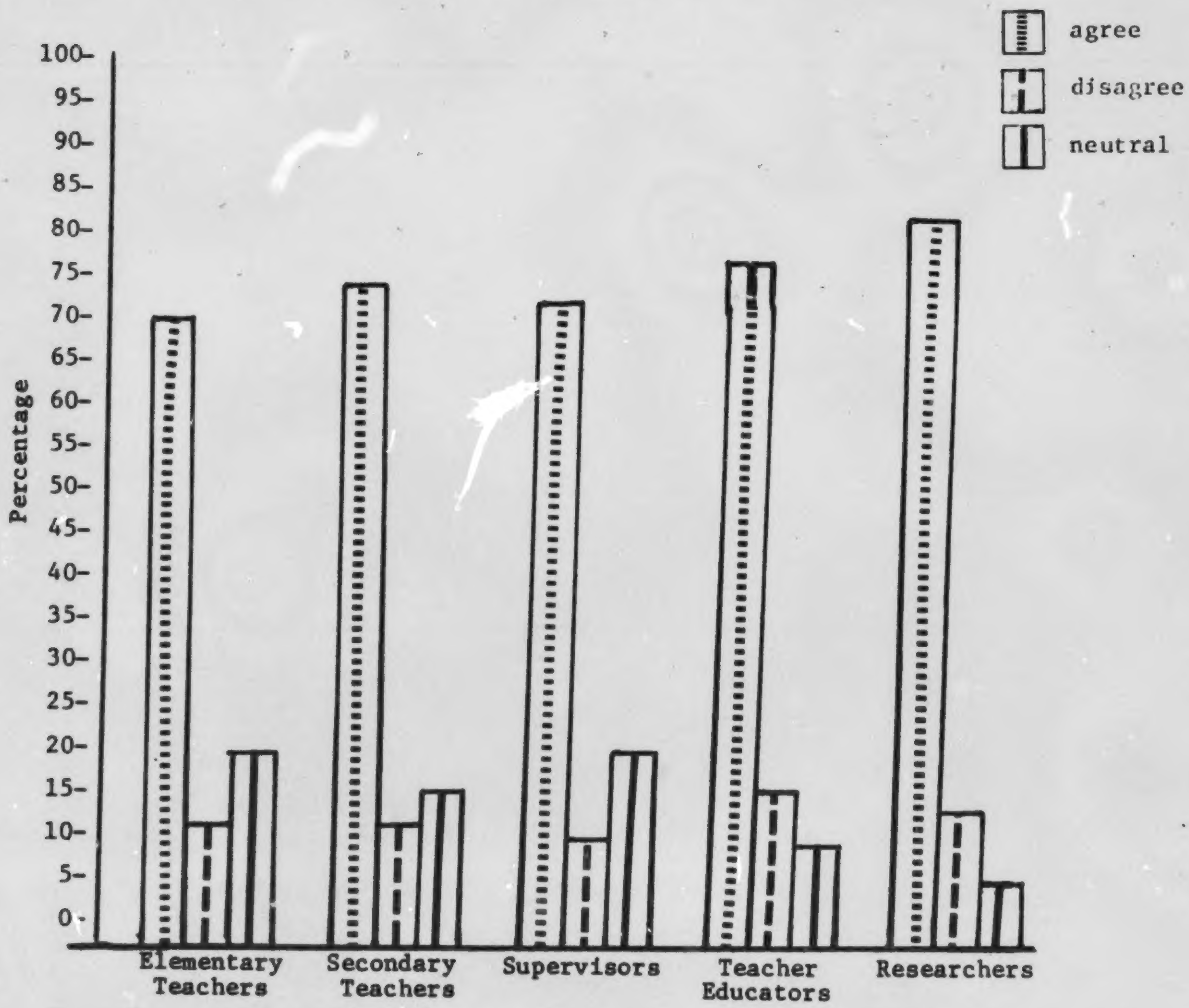
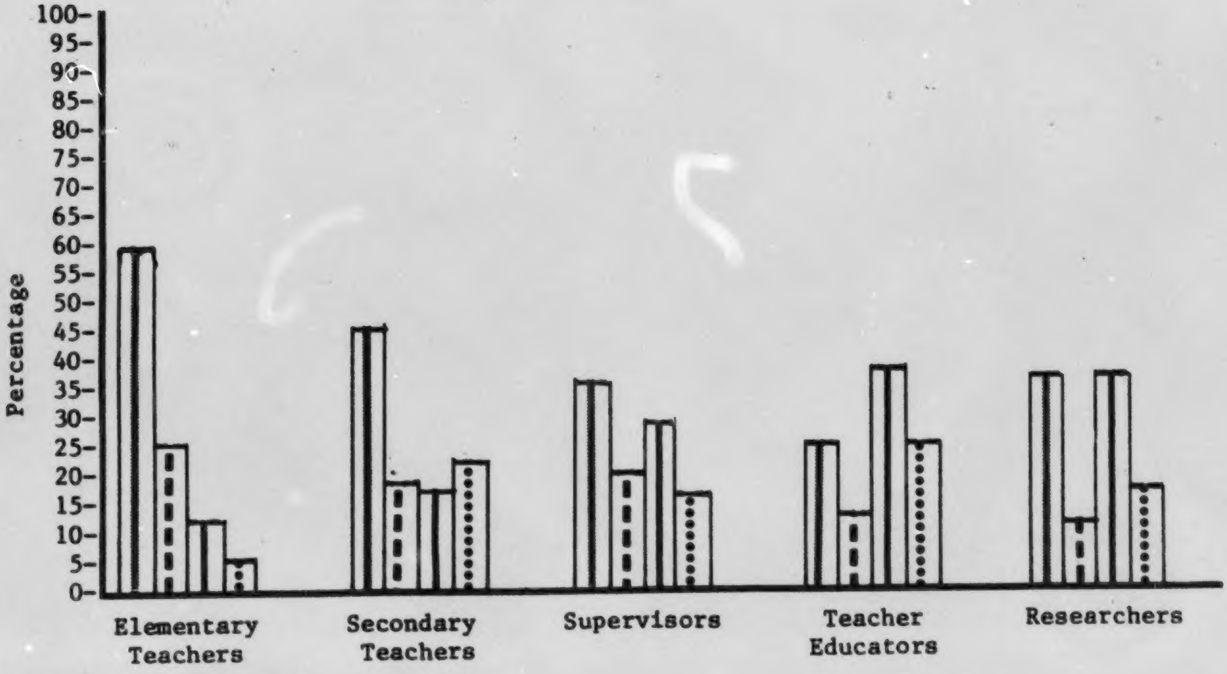


TABLE B 4.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	59	45	35	25	36
agree with extention	25	18	20	13	11
agree with exception	11	16	29	37	36
disagree	5	21	16	25	17

GRAPH B 4.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(44)	(49)	(49)	(72)	(45)

TABLE B 4.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	11	Changes should also reflect society's values	3
		Because goals are evolving	2
		Because science knowledge change	2
		Change is inherent to ALL fields of education	3
		and we should deal with their long range effects	1
Secondary Teachers	9	When scientific models no longer predict and explain, new models are devised	2
		Strategies are in need of change now	2
		Piaget and Bloom have caused us to re-think our goals	3
		Question whether it's inherent or essential	2
Supervisors	10	Biggest change needed is "updating knowledge" to relate to industry research	3
		Inherent to all education	2
		Very nature of science is one of constant change and searching; science education should reflect this	3
		Understanding how an individual learns will demand alteration of techniques and strategies	2
Teacher Educators	9	Change, yes; pendulum swings, no	4
		Change can be accommodated without changing science processes	3
		Applies to all of education	2
Researchers	5	Science education like science cannot become paradigm limited	3
		Change and stability must be seen as antinomy	2

N = Number of Responses
F = Frequency of Responses

TABLE B 4.4 Tabulation of Open-Ended Responses Which Take Exception to Position

Group	N	Summary of Responses	F
Elementary Teachers	5	No important change in last 20 years	2
		Change is often a frightening frustration to deal with	1
		Strategies do not change as much as the goals and curriculum	1
		Goals and strategies do not change	1
Secondary Teachers	8	Can be too haphazard a fashion	1
		Keeps our ideals and goals	6
		Only because of new knowledge	1
Supervisors	14	If new modes of evaluation are not devised, changes will not be under scientific control	2
		The goals do not change	4
		Not the curriculum	1
		To keep too current means science education can become too shallow	3
		Need to be cautious not to change for the sake of change	2
		We neglect to evaluate the changes once they are in place	2
Teacher Educators	27	Search for the "best" as though there were a best is futile	3
		As they are implemented, the change is actually very minimal and slow	5
		We need to use the past as a guide to the future	2
		Not much action apparent	3
		Too often the lead in change comes from without the school	3
		Should not be only determined by the needs of society	2
		Not the goals	6
		Mostly it is not	1
		Only in emphasis of goals	2
Researchers	16	We are perpetually guilty of believing that change affects the mass of science teachers	3
		Imput for change occurs primarily at the theoretical level	2
		Goals will remain constant	6
		Only when teachers are convinced that change is needed	1
		They change at different rates	1
		Knowledge changes and so must curricula, but the nature of science does not	2

N = Number of Respondents
F = Frequency of Responses

TABLE B 4.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	2	Must adhere to basics	2
Secondary Teachers	10	We must not give up teaching strategies even though there is pressure to do so	4
		Better to learn basic principles and then apply them to new situations	1
		Less emphasis on the inquiry approach	1
		Not if it means inherent only	3
		They simply are not changing	1
Supervisors	8	Such a position is idealized beyond any reality	2
		We must emphasize the teaching of basic skills	3
		Maybe part of the problem with science education is that it is changing all too often	2
		There are changes, but not inherent causes	1
Teacher Educators	18	There seem to be some continuing threads, but not major changes	3
		Changes only exist in the Federal Programs where money is the change agent	3
		Science education is dogmatic in some ways	2
		Change should not be a dominant concern of science teachers	2
		Only the content changes	3
		Depends on the function of schools which one advocates	2
		The idea of change is merely a way of returning to a "Big Day" for science teaching	3
Researchers	8	There has been nothing new in the last 40 years	4
		Little change has occurred in the last 3-5 years	3
		It is more accurate to say that goals are clarified rather than changes	1

N = Number of Respondents
F = Frequency of Responses

B 5. GENERAL REACTION TO THE "AIMS" SECTION AND A LISTING OF SPECIFIC POINTS OF DISAPPOINTMENT

TABLE B 5.1 Result of Respondent Ratings*

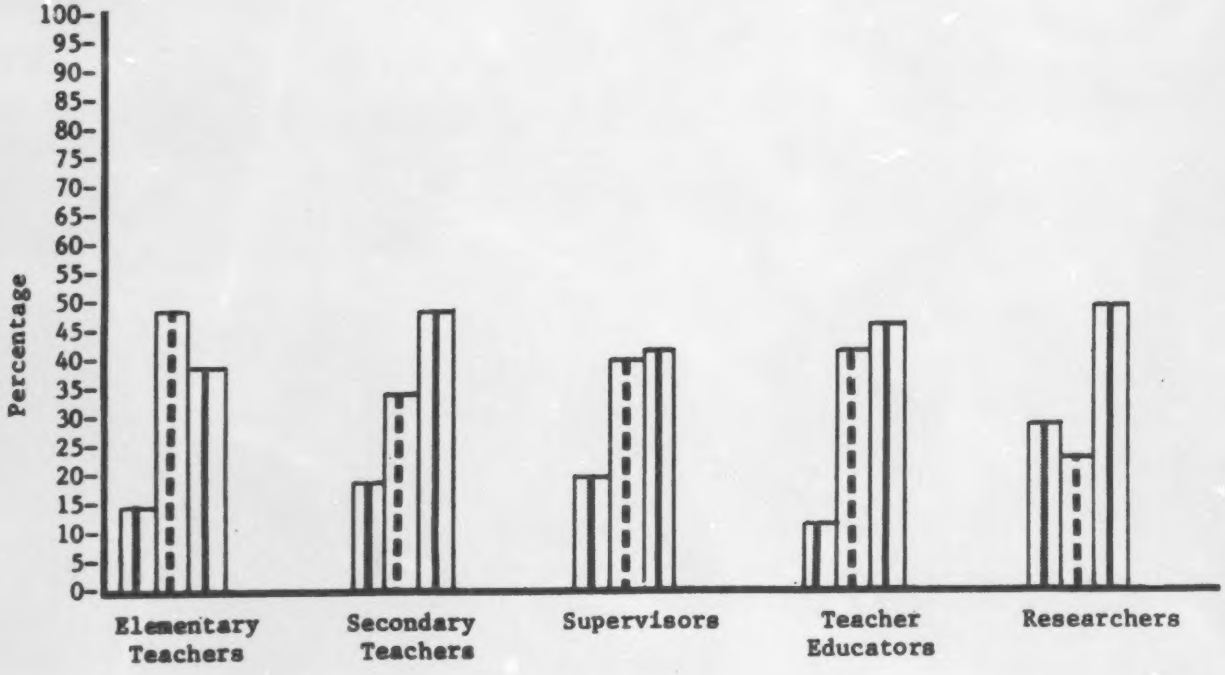
Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
excellent	14	18	19	12	28
satisfactory	48	34	40	42	23
disappointing	38	48	41	46	49

▯ excellent

▯ satisfactory

▯ disappointing

GRAPH B 5.1 Graphic Presentation of Respondent Ratings



*Numbers Providing Comments

(42)	(60)	(58)	(66)	(43)

TABLE B 5.2 Tabulation of Open-Ended Responses Listing Points of Disappointment

Group	N	Summary of Responses	F
Elementary Teachers	42	Not enough discussion on how to reach goals	5
		More attention to inderdisciplinary techniques would be desirable	3
		Need attention to re-education the public	2
		Foundation more important than "literacy" per se	2
		Need more conformity as to goals and curriculum	2
		Too much emphasis on change	1
		Too limited a view of science	1
Secondary Teachers	60	Vehicle for realizing aims not clear	4
		Not enough emphasis on interdisciplinary approaches and meaning	4
		Too much a look back	3
		Organization around societal topics not clear	2
		Attempt to make old look new	2
		Individual difference discussion not needed	2
		Too little attention to how we got more to "buy into" the aims	2
		Some suggestion of indoctrination	2
		Too much emphasis on "ways of learning"	2
		Recognition of future needs	1
		Meaning of "attitudes"	1
		More specific demands and standards needed	1
		Too little consistency from school to school, region to region	1
		"Book Learning" may be good	1
		Not enough reference to elementary schools	1
Supervisors	58	Too little attention to science-technology interface	4
		Too little hypothesizing on future	3
		Too much societal emphasis will make science indistinguishable from social studies	2
		No recognition that what we know now is only partial	2
		Need to identify specific strategies for literacy	2
		Learning theory is glamorized	2
		Many positive societal changes ignored	1
		Too little emphasis on real evaluation	1
		Need directions for applying Piaget	1
		Too much focus on demands of society	1
		Emphasis on change for sake of change	1
		Too much emphasis on value of research	1
		Ways of reducing gap between recommended and actual classroom practice	1
		Need more humility	1
		More emphasis on values	1

N = Number of Respondents
F = Frequency of Responses

TABLE B 5.2 Tabulation of Open-Ended Responses Listing Points of Disappointment (continued)

Group	N	Summary of Responses	F
Teacher Educators	66	Too little on human aspects	4
		Science not for all people	3
		Too much dilution of real science	3
		History good, but current directions not clear	3
		Too little on interdisciplinary efforts	3
		Lack of "community" in the profession	2
		Methods of science won't resolve societal problems	2
		Too little on helping students to use problem solving	2
		Difference between theory and what teachers do	2
		Not enough new ideas	1
		Need more massive implementation efforts	1
		Too much emphasis on science for it's own sake	1
		Wrong interpretation of Piaget's work	1
		Piaget should not be only theorist cited	1
		Nothing on general learner motivation	1
Researchers	43	We really have not considered "process" in teaching	3
		Too little attention to translating goals into practice	3
		Knowledge, attitudes, and methods of science don't help people cope with problems	3
		Too little attention to aims and approach to instruction	2
		More stress on technological frontiers	2
		Aims too ambitious	2
		Too little attention to the meaning of "needs of society"	1
		Too idealistic	1
		Work of Piaget is harmful	1
		Vague use of verb "understands"	

N = Number of Responses
F = Frequency of Responses

C. Analysis of Section on Present Situation of Science Teaching

This section of the working paper is divided into two major sections. The first deals with sources of satisfaction and hope for science education. The two general areas of satisfaction and hope which are discussed deal with new curricula and in-service education. Two statement from the page-and-a-half discussion of new curricula and two from the one and one-half pages of discussion of in-service education provide the basis for the evaluation of the presentation for five leadership groups in science education. These results are included as Tables and Graphs C 1.1 to C 4.5.

Table and Graph C 1.1 provide information concerning agreement that the science curriculum materials developed during the two decades, (1959-1979) were significant. There is general agreement (over 80 percent for all groups and as high as 93 percent for the researchers). The teacher educator group provided the greatest disagreement (13 percent) while secondary teachers and researchers reported very little disagreement (1 percent and 4 percent respectively).

Table and Graph C 1.2 represent a general tabulation of the open comments. In some respects the analysis of the open comments provides contrast to the results provided by the rating scale (C 1.1 above). The open comments emphasize specific exceptions to general agreement and the reason that there were relatively few, in the total sample, who disagreed. The number of comments with exceptions to the general agreement that the programs have been significant (except for the elementary teacher group) emphasizes the difficulty with making such general all-encompassing statements in such a position statement. The great satifaction among the secondary teacher sample (no disagreement) and the number of comments from researchers (some individuals contributed more than one comment) make the exception and disagreement statements unrepresentative of the entire sample.

A second view of the importance of the new curricula of the 1960's and 70's was attained by asking opinions of the following position: There is a continuous and logical evalution of the curriculum programs of the 60's and early 70's to the new programs for the 80's. Table and Graph C 2.1 provide the results of the degree of agreement with this position. The two teacher groups agree (two-thirds of the secondary teachers and three-fourths of the elementary teachers), while less than one-third of the researchers and less than half of both the supervisor and teacher educator groups agree. This position then results in agreement-disagreement patterns that split groups while providing some pairings.

Table and Graph C 2.2 provide a view of a categorization of the open comments. The respondents who basically agree often provide extensive qualifications and often more than a single exception. Similarly, the respondents who disagree provide more open comments and elaboration concerning their disagreement than do persons who are in complete agreement. Tables C 2.3, C 2.4, and C 2.5 are tabulations of the statements which agree with added information included, those which generally agree with reservation or exceptions, and those that disagree respectively.

The second part of the first section of the Sources of Satisfaction and Hope sub-section of the "Present Situation of Science Teaching" is concerned with in-service education. Two position statements are used to assess degree of support for the major ideas in this section of the paper. The C 3. and C 4. series of tables indicate the results.

The first position statement contended that NSF support for teacher education during 1959-79 resulted in changes in teacher behavior in classrooms. Table and Graph C 3.1 show a tabulation of the results from the checklist rating. Again, some real differences are apparent. The two teacher groups (78 percent of the elementary teachers and 84 percent of the secondary teachers) agree that changes in teacher behavior resulted. About half of the supervisors and teacher educators believe that such changes can be observed, with a third of each group disagreeing. The researchers provide a contrast; half of the respondents disagree that the institute efforts resulted in changes in teacher behavior.

Table and Graph C 3.2 indicate the results of categorizing the open responses related to the contention that NSF institutes resulted in major changes in teacher behavior. As previously stated, both the number and the nature of the exceptions given by the respondents in each sample are of interest. There is general agreement that the impact has declined since 1970, the approximate time for major declines in funding levels. There is concern as well for the magnitude of the changes and their longevity.

The tabulation of the comments which tend to agree with the position seem to be in basic agreement among groups as reported in Table C 3.3. The comments which were classified as basic "agreement with noted exceptions" are tabulated and appear in Table C 3.4. In this instance some differences are noteworthy. Elementary teachers report concern that more institutes were not offered for elementary teachers. Secondary teachers are concerned with the nature of institutes (i.e., focus on NSF curricula, the nature of teachers who were selected for attendance, and the duration of the support.) The supervisors were concerned with the teachers involved, the support for carry-over activities, the lack of focus on methodologies, and the failure to recognize the institute programs as a part of an overall in-service effort. The researchers were concerned with the modest changes in teacher behavior that were planned, the duration of such changes, and the problems associated with collecting evidence for long term changes.

Table C 3.5 is a tabulation of the responses which diagreed with the position advanced in the working paper. The number and intensity of responses reflect those provided in the checklist responses. Both the number and intensity of the comments expressing disagreement were few for the two teacher groups, moderate for the supervisors and teacher educators, and significant for researchers.

A second item concerned with in-service education stated that there is a major need for science teachers to be more knowledgeable about specific strategies for meeting goals as they plan for new directions for the 80's. Table and Graph C 4.1 report the results of the general reactions to this proposition from all five groups of respondents. The very strong agreement (80 percent among the elementary teacher group) and among secondary teachers (66 percent) amd supervisors (62 percent) is of interest. Fewer than 50 percent of both the teacher educator and research groups agree with the position. This is surprising for the teacher educators since their major mission is assisting teachers (traditionally preservice teachers to be sure) with instructional strategies. Perhaps they feel that recognizing it as a continuing need suggests their lack of success during collegiate preparation. In view of previous positions taken by researchers, it was also of interest to note the small number which agreed to the importance of teacher knowledge of teaching as a major need for the 80's.

Table C 4.3 is a tabulation of specific suggestions which support and expand the contention that a major need of science teachers is knowing more about strategies for use in meeting objectives. The teacher groups provide the greatest number of such suggestions. The ideas advanced do not appear to offer different foci among the five groups.

Table C 4.4 is a similar tabulation of the comments from the five sample groups that list exceptions to the position while indicating general agreement. Many persons, however, who stated exceptions to the position were the ones who chose "neutral" as their response on the rating scale for this topic.

Table C. 4.5 is the tabulation of the open comments which explain the basic disagreements among the groups on the issue of teacher need for knowing more about specific teaching strategies designed for meeting specific instructional goals.

Of interest in this table is the fact that some persons in each sample disagree with the need for better teaching strategies for meeting goals because there is a greater need for more subject matter competency. This need is expressed by only one researcher but by many respondents in the other groups. Another significant comment was concerned with information on learning and science teaching. Teacher disagreement (both groups) also focused on active teacher involvement in the preparation of materials and use of strategies unique to them. Several supervisors, teacher educators, and researchers disagree with the position because of a perceived greater need for the development, the clarification, and the reformulation of goals for science teaching.

The second major division of the paper section entitled "Present Situation of Science Teaching" centered on areas of concern for science education today. Six specific concerns were identified and discussed presumably in order of importance/concern to the profession. These areas include population trends, decreased funding, decline of science in the total curriculum, problems with accountability, changes in students, and unionization. A single item, stating that each of the areas was a "major concern," was included in the survey instrument with a request for explanatory comments. Two questions were inserted in the questionnaire following these six items. One asked for a rating of the relative importance of the six areas of concern; a second asked for the identification of other important concerns that were judged to exert significant impact on science education for the 80's.

Table and Graph C 5.1 provide the results regarding the degree of agreement that population changes pose major concerns for science teaching for the 80's. Well over half of the elementary teachers, the secondary teachers, and the supervisors agree while slightly under half of the teacher educators and the researchers agree.

Table and Graph C 5.2 shows tabulations of the open comments regarding population trends as a major concern in science education. The results merely amplify and refine the general trends represented by the rating scale reported in C 5.1.

Tables C 5.3 C 5.4, and C 5.5 provide a summary of the comments provided by each of the single groups. Table C 5.3 represents the ideas which tend to expand the basic idea; Table C 5.4 categorizes the exceptions various respondents take to the basic premise; Table C 5.5 is a summary of comments by the group in each research sample which disagreed with the position advanced in the working paper.

Table and Graph C 6.1 show the rating of the contention that decline in funds available for science education is a major concern for the 80's. It is at once apparent that there is great agreement among secondary teachers and supervisors (over 90 percent) and nearly as great an agreement for elementary teachers and teacher educators (87 percent and 88 percent respectively). Although not as significant, nearly two-thirds (65 percent) of the researchers also agree that inadequate funding is a major problem for science teaching today.

Table and Graph C 6.2 report the results of the categorization of open comments. The patterns are again generally consistent with the patterns from the general ratings.

Table C 6.3 is a tabulation of general supportive comments which tend to add a dimension to the position. These responses seem to provide suggestions for use of existing funds and areas for which funds are needed. In general, these suggestions are consistent with the uses of funds for which each professional group could be expected to advance, i.e., funds for more materials and direct assistance for teachers, more funds to support consultive services for supervisors, and funds for evaluation for researchers.

Table C 6.5 is a tabulation of the responses which disagree. Although the number of respondents was relatively low, the number of responses from the secondary teachers, the teacher educators, and especially the researchers is unexpectedly high. Several individuals gave more than one reason for their disagreement with the contention that budget constraints represent major causes for alarm. Several suggest that excellent science experiences can be provided at very low costs.

Table and Graph C 7.1 provide the results of the ratings given to the decline in enrollments in science classes as a major cause for alarm. Generally, all groups agree that it is a major concern for the 80's. About three-fourths of the elementary teacher, secondary teacher, supervisor, and teacher educator groups agree while under two-thirds (60 percent) of the researchers agree.

Table and Graph C 7.2 provide information on a categorization of the open comments provided by each of the sample groups. The same trends emerge. However, the tabulations only represent that part of the total sample choosing to provide comments--probably suggesting stronger ideas concerning the problems for science teaching which result from enrollment declines.

Table C 7.3 provides a list of comments which add a dimension to the original position stated. Many comments suggest actions that are possible and/or recommended because of enrollment declines. Other comments suggest what such declines are likely to mean--i.e., why declines are a major concern.

Table C 7.4 provides information concerning exceptions that individuals within the sample group make regarding the idea that enrollment declines are a cause for concern. The exceptions dwell on the need for a look at real declines in science when general enrollment declines occur in the entire school. Others consider having fewer students an opportunity for emphasis upon quality instruction. Several see the concern as a time of opportunity, change, and advancement.

Table C 7.5 provides a tabulation of the comments which disagree with the premise that enrollment declines are a cause for alarm. Many of these "disagreements" use the same explanations that were used by the group which basically agreed but stated exceptions and/or qualifications on such agreement. Some suggested again that enrollment declines can mean opportunity to work toward improved science experiences for all students. Some respondents simply refuted the statement that there are real declines in student enrollments in science.

Table and Graph C 8.1 indicate results on the rating instrument where accountability and competency-based programs were identified as major concerns to the profession for the 80's. There is strong agreement among elementary teachers, secondary teachers, and supervisors (about 76 percent from each group). Although there is considerable agreement among teacher educators and researchers, that agreement is stated by only about half of each group.

Table and Graph C 8.2 provide an indication of the nature of the open comments regarding this issue. Similar trends emerge as presented with the general ratings. As previously stated, differences occur since several respondents chose not to comment; others give more than a single response. It is therefore important to keep in mind that the numbers and the percentages represent responses not remajor concern for science instruction in the 80's.

In the recommendation section teacher educators and researchegrams are major concerns for science education for the 80's. Table C 8.4 is a tabulation of exceptions the responding groups elaborated while basically agreeing that these concerns are major ones. Contrastingly, Table C 8.5 is a tabulation of the negative comments from thos respondents who disagree that accountability and competency-based programs are concerns for science educators as the 1980's begin. The reasons given across responding groups are similar. However, the total numbers disagreeing with the importance of these concerns were nearly twice as great among teacher educators and researchers (generally college personnel) than among the other three groups.

80

Table and Graph C 9.1 indicate the ratings of the sample groups regarding the position that students are vastly different today than in past years, a fact that presents a major concern for science education for the 80's. The two teacher groups strongly support this position (79 percent of the elementary teachers and 64 percent of the secondary teachers). Fewer than half of the other groups agree that this is one area of major concern in science education for the 80's. Significant numbers disagree with the position as well (36 percent of the teacher educators and 38 percent of the researchers). It is interesting to note that the researchers almost split evenly between those who agree and those who disagree.

Table and Graph C 9.2 provide a view of the categorization of the open comments concerning the importance of the changing nature of students as a concern for teaching science. As in previous instances, the comments permit an analysis of the reasons, the bases, and the intensity of opinion regarding the issue.

Table C 9.3 provides a tabulation of the open comments which extend or elaborate upon the basic proposition. It is interesting to note the great number of descriptors for the changes in students today over yester-years as listed by teachers (38 from elementary teachers and 24 from secondary teachers). Supervisors, who are generally closer to schools than are teachers educators and/or researchers, also include many more examples which suggest agreement with the contention that students are very different today than they were previously.

Table C 9.4 provides a tabulation of exceptions to the basic position while professing general agreement. Unlike many other areas where opinion was requested, this one (agreement that students are different and that this is a major factor for planning science programs for the future) resulted in few exceptions and/or qualifiers from any of the responding groups. Persons either agreed or disagreed. Only a total of twenty-five statements from all five groups were put in this category.

Table C 9.5 is a tabulation of the comments which tended to disagree about either the truth in the contention that students are vastly different or whether it is a major concern for science teaching for the 80's. Few reasons and/or elaborations for the contention that students are much the same as they have always been are advanced by any of the groups.

Table and Graph C 10.1 are concerned with a report of the sixth and last area of concern for science teaching for the 80's by the authors of the working paper. This deals with the contention that teacher unionization is a major issue. Most of the sample are evenly divided between those of the particular group who agree and disagree that teacher unionization is a major concern. It is interesting to note that nearly half of the secondary teachers group disagrees compared to one-fourth who agree. This is the only sample group where there is such a discrepancy. The teacher education sample is the only other group with nearly half of the respondents disagreeing with the statement.

Table and Graph C 10.2 provide an indication of the types of open comments given by respondents as well as differences among the groups for such comments. Again it is interesting to note the great divergence of feeling within all groups on this issue.

Table C 10.3 provides a tabulation of the open comments which were judged to expand on the idea (unionization as a major concern in science education today) surveyed. The divergence of response, philosophy, and interpretation in this area are very great for all groups. This "concern" appears to stimulate many extensions, relationships, fears, and related concerns.

Table C 10.4 is a tabulation of open responses which tend to agree with the importance of teacher unionization while advancing an exception or alternative view. Table C 10.5 is a tabulation of all responses for the five groups which disagree that teacher unionization is a major concern in science education. As in the previous instance, these disagreement comments seem merely to indicate disagreement with few additional insights given.

As indicated previously, respondents were asked to rank in order of importance the five areas of concern for science teaching identified in the working paper. Unfortunately, the first area of concern in the paper, population trends, was not included in the list of concerns respondents were asked to rank. This is unfortunate since the authors of the working paper ranked it as most important as the profession plans for the 80's. As one compares the levels of agreement on the individual items (Table C 5.1, C 6.1, C 7.1, C 8.1, C 9.1, and C 10.1), there is evidence that respondents rank population trends as less of a concern than decreased funding, enrollment declines, accountability and competency-based programs and about equal in importance to the changes in students as factors of concern needing attention as professionals plan for the future.

Table C 11.1 is a tabulation of the ratings of the five concerns (funding, enrollment, accountability, changing students, and unionization) provided by respondents in each group. Many of the respondents did not comply with this request. The following number in each sample provided some information: elementary teachers--28, secondary teachers--36, supervisors--38, teacher educators--36, and researchers--21. Of these, far fewer gave a specific numerical ranking to the five areas of concern. Hence, the rankings reported in Table C 11.1 arise from the following numbers: elementary teachers--8, secondary teachers--12, supervisors--14, teacher educators--15, researchers--10. A careful analysis of all comments revealed consistent agreement with the relative rankings provided by that sub-sample--those who gave a one through five rating for all five concerns with one assigned to the concern viewed as most important by a given respondent). The total response for each group enabled one to determine the ranking for each of the concerns. The totals are included to permit a comparison within each sample of the degree of difference.

It is at once apparent that the decrease in funding for science education is viewed as the most urgent concern of the five that were ranked. There are interesting differences within groups and across groups, especially when comparisons are made with the intensity of agreement and/or disagreement concerning a given issue. In many respects it is disappointing that so few persons took time to rank all of the concerns as requested.

Respondents were asked to suggest other concerns which are current and likely to affect science educators for the 1980's. Table C 12.1, are the tabulated responses to this request for "other" major concerns for science educators. Many individuals provided a list of several concerns; some only one; some ignored the request. Following is a list of numbers of respondents in each group who provided one or more concerns in addition to the six identified in the working paper:

Elementary Teachers	39
Secondary Teachers	63
Supervisors	53
Teacher Educators	64
Researchers	29

The lists reported in the five tables are long and largely unedited. They are so reported for fear of losing an idea using a more general classification scheme.

The last item in the questionnaire for this section (Present Situation of Science Teaching) was similar to that used at the close of sections A (Introduction) and B (Aims of Science Teaching). The comments are classified and reported in Table and Graph C 13.1. It is apparent that by far the majority in all groups gave this section a rating of satisfactory. Several in the teacher groups rated the section as excellent. Significant numbers in the supervisor, the teacher educator, and the researcher groups found the section disappointing.

Respondents were also asked as an open question to state disagreements with the format, the inclusions, the ideas in the "Present Situation in Science Teaching" section. Table C 13.2 is a tabulation of these statements of disagreement. As previously indicated, groupings of ideas were accomplished with caution in order to preserve all ideas advanced by the leadership in science education that is represented in each of the groups. Many of the statements were edited and shortened in order to preserve space and the table format for this report.

84

C 1. SCIENCE CURRICULUM MATERIALS DEVELOPED DURING 1959-79 WERE SIGNIFICANT CONTRIBUTIONS

TABLE C 1.1 Result of Respondent Ratings

		Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
Percentage	agree	81	86	85	82	93
	disagree	7	1	8	13	4
	neutral	12	13	7	5	3

GRAPH C 1.1 Graphic Presentation of Respondent Ratings

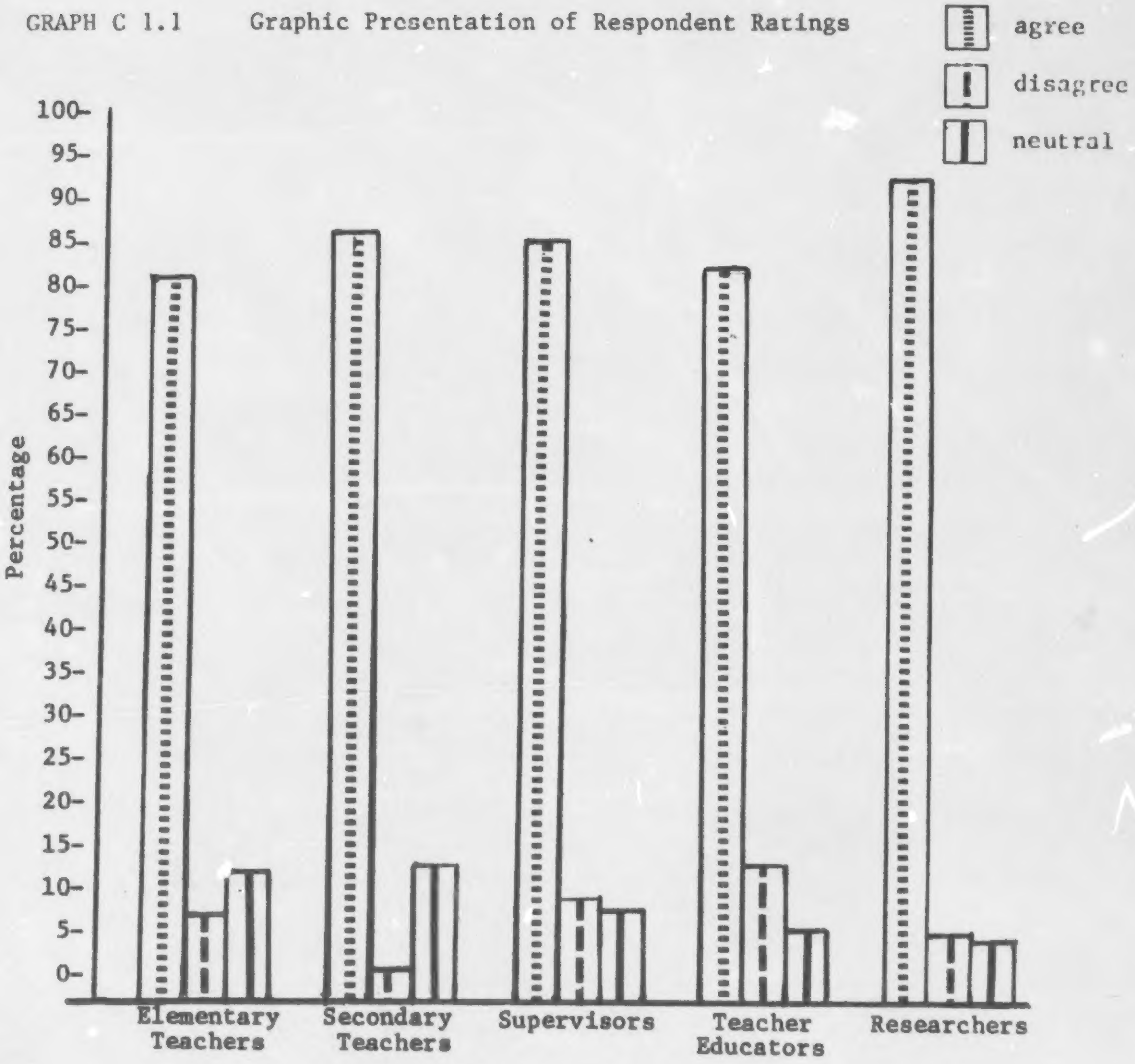
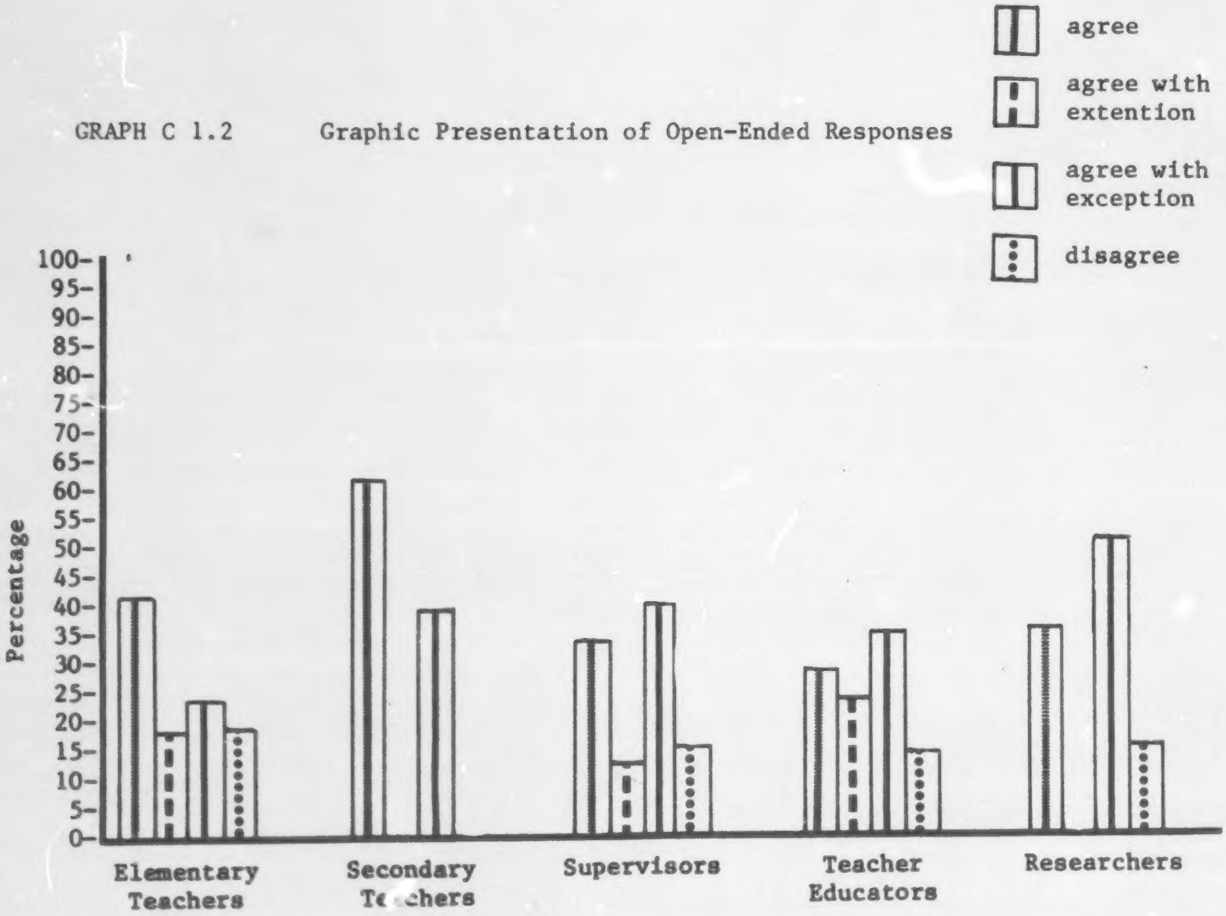


TABLE C 1.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	41	61	33	28	35
agree with extention	18	0	12	23	0
agree with exception	23	39	40	35	50
disagree	18	0	15	14	15

GRAPH C 1.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
(39)	(54)	(60)	(71)	(40)

TABLE C 1.3 Tabulation of Open-Ended Responses Which Extend Position

Group	N	Summary of Responses	F
Elementary Teachers	7	Because many curriculum programs now use inquiry/ discovery	4
		Need still more for mainstreamed child	3
Secondary Teachers	0		
Supervisors	7	Government spending took the curricula out of the "ivory tower"	3
		And a much broader spectrum of approached is available today	4
Teacher Educators	16	Both quality and quantity	2
		Programs were more representative of knowledge	3
		Changed emphasis from content to process	5
		Eliminated popular textbook series as basis of science education curriculum	3
		Made science educators begin to think about what they are doing and why	3
Researchers	0		

N = Number of Respondents
F = Frequency of Responses

TABLE C 1.4 Tabulation of Open-Ended Responses Which Take Exception to Position

Group	N	Summary of Responses	F
Elementary Teachers	9	They are seldom used by most teachers	3
		Not enough, more to be done	4
		Availability is a problem due to lack of funding	2
Secondary Teachers	21	Good for the academically talented student only	4
		Problems (like reading level and too much inquiry) now being taken care of by more balanced programs	3
		Not enough teacher training for implementation	6
		Did not go far enough	2
		Not as active in the last 10 years	2
		Not enough for the junior high schools	4
Supervisors	24	Never properly implemented	6
		Overemphasis on concepts	3
		Quantity does not insure quality	3
		Only for those fortunate enough to be involved	2
		Problems occurred because programs never broadly applicable enough	3
		Numbers, yes; rationale, no	4
		Oriented too much toward the elite students	3
Teacher Educators	25	Not very significant to pupils	2
		Lack of use due to lack of teacher training	6
		Lack of impact and implementation	8
		Not exemplary	3
		Did not have enough emphasis on inquiry	2
		Not in the late 70's	4
Researchers	20	Teachers are not using them	7
		Schools are not aware of them	4
		Have not been properly evaluated	3
		For high achievers only	4
		Curriculum makes only a very small difference	2

N = Number of Respondents
F = Frequency of Responses

TABLE C 1.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	7	Needs still unmet	4
		Discovery method was counter-productive	3
Secondary Teachers	0		
Supervisors	9	Not much evidence to support this	4
		Did not improve matters	2
		Much of the equipment was not used; it was also too costly	3
Teacher Educators	10	NSF's effect today is measurable but negligible	2
		Because teachers, administrators, students, have not been involved	3
		Learning still appears to be declining	3
		Look at all the "package" programs and note the ones still available	2
Researchers	6	Noticeable but not significant	3
		Waste of time and money on ephemeral "technique projects"	2
		Significant is too value laden a term to be used	1

N = Number of Respondents
F = Frequency of Responses

C 2. THERE IS CONTINUOUS EVOLUTION OF MATERIALS AND TEACHING APPROACHES 1960 TO PRESENT

TABLE C 2.1 Result of Respondent Ratings

		Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
Percentage	**agree**	77	65	45	47	31
	disagree	6	14	28	38	60
	neutral	17	21	27	15	9

GRAPH C 2.1 Graphic Presentation of Respondent Ratings

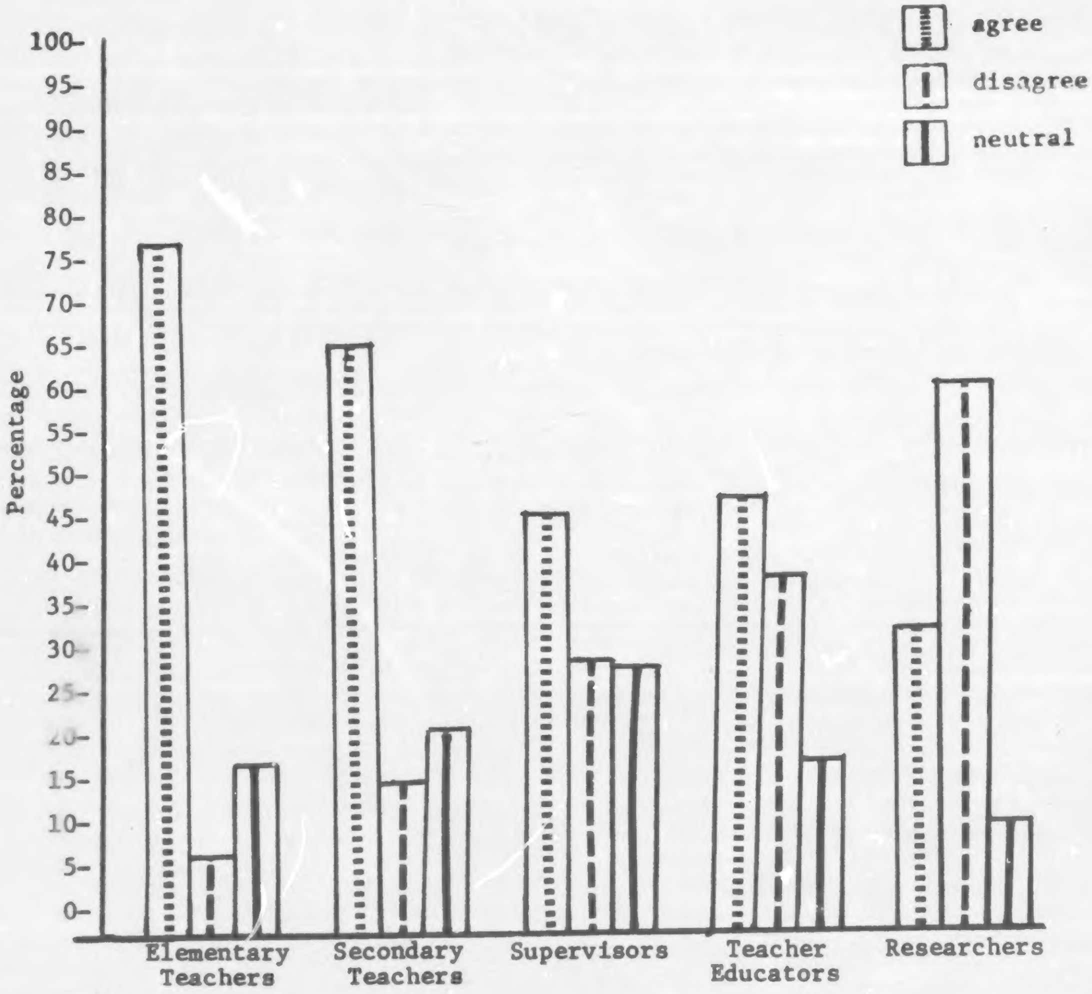
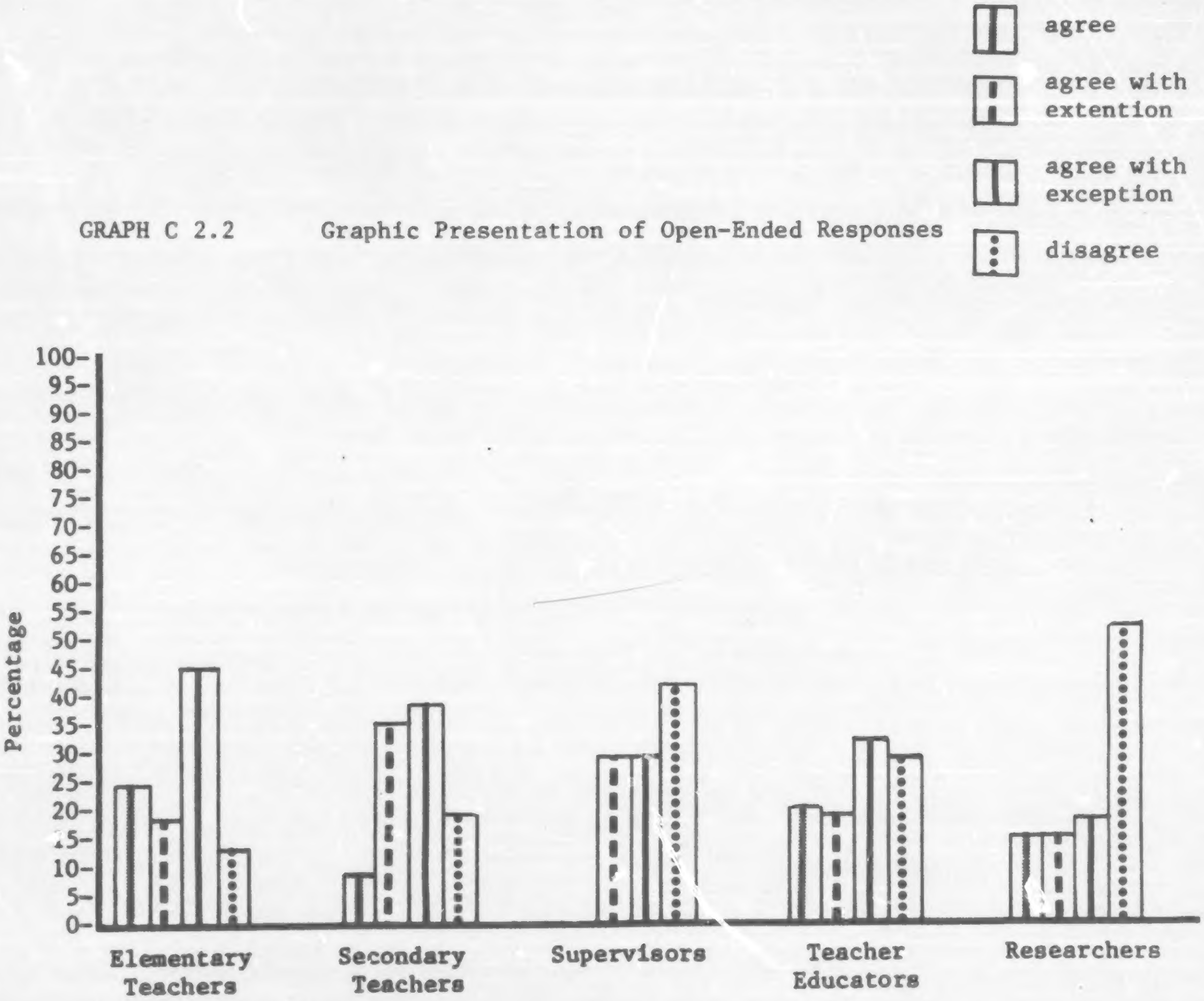


TABLE C 2.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	24	8	0	20	15
agree with extention	18	35	29	19	15
agree with exception	45	38	29	32	18
disagree	13	19	42	29	52

GRAPH C 2.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(55) (52) (51) (69) (54)

TABLE C 2.3 Tabulation of Open-Ended Responses Which Extend Position

Group	N	Summary of Responses	F
Elementary Teachers	10	They should include programs for modern technology	4
		Need help with energy, conservation, and other current issues	6
Secondary Teachers	18	Illustrates that new directions are needed	5
		Must include environmental and energy issues and problems	3
		Must consider students of the 80's	4
		Especially since teachers have started to use them as stepping stones	2
		Must be maintained by increased inservice	4
Supervisors	15	Practice of summer institutes and inservice should be revised	4
		Funding is necessary	2
		New programs must stress application of science to societal problems	4
		Need to provide more alternative methods so more student-oriented	2
		Tight budgets, back to basics and decreased inservice force us to look backward to sort out what is possible	3
Teacher Educators	13	Problems of the curricula of the 60's indicate directions	3
		New emphasis is on teacher change	2
		Including revisions and refinements of the 60's	3
		Toward establishing metaphysics of majority	1
		Including global science related problems	2
		Especially since new teachers still seem most influenced by their cooperating teachers	2
Researchers	8	If back to basics does not kill them first	3
		If they are used as models of how to and how not to	3
		If it includes the classroom teacher in the development	2

N = Number of Respondents
F = Frequency of Responses

TABLE C 2.4 Tabulation of Open-Ended Responses Which Take Exception to Position

Group	N	Summary of Responses	F
Elementary Teachers	25	Need more stimulus to adopt what has already been produced	15
		Need more supervisors to encourage teachers	3
		Not enough inservice programs	2
		Must not eliminate possibility for new ideas	3
		Only if there is complete follow through and no stagnation	2
Secondary Teachers	20	Will not do any good unless teachers are prepared in inquiry	3
		Should not discard good things just because they are old	4
		We need to revise the way in which lab oriented programs are used	4
		The longer publishers have them, the more uniform they become	3
		Now losing gains we had	3
		Needless emphasis on inquiry	1
		The current inertia does not mean they were not good	2
Supervisors	15	Those that are heavily "inquiry" oriented may not survive	4
		Content must be updated	3
		Change must include popularizing science	2
		Back to basics could slow up the process	3
		Research is important to insure the right ways	3
Teacher Educators	22	More inservice needed	6
		Only to the extent they have been implemented	3
		Should also include or evolve some new ideas	3
		Excellent programs of the 60's were prostituted in the 70's.	1
		More emphasis on society and impact of science on personal lives is needed	2
		Only a few suggested strategies and have not shown significant results	2
		Back to basics is eroding away the gains	3
		Need to include citizen-oriented curricula	2
Researchers	10	But the models need improvement	3
		Not for unified science approaches where the thrust is for the teacher	1
		Teachers lack strategies for implementation	2
		Materials of present programs do not necessarily relate to current research	3
		Those definitely that deal with individualization	1

N = Number of Respondents
F = Frequency of Responses

TABLE C 2.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	7	Actually were controlled and implemented for men	2
		Get rid of the canned programs	3
		Do not think we were always heading in a sensible direction	2
Secondary Teachers	10	Need entirely new approach	2
		Many too "hung up" on relevance	3
		Many programs ignored all but bright	5
Supervisors	21	Too many college people have lost touch with reality	3
		Not with current economics	2
		Little in NSF programs on strategies to begin with	4
		Package programs have done damage to untrained teachers	2
		No clear goals appear	4
		Good teachers teach no matter what	2
		Use the scientific method to solve all problems	2
		Too heavily concerned with inquiry; all need to be rewritten	2
Teacher Educators	20	We have new problems (new students) and need new strategies	3
		Old curricula have not turned on kids	3
		Most teachers never did change	2
		Innovations need to come from local level	2
		Programs were too discipline-oriented	3
		Period of cycle is too short to predict	2
		It is difficult to imagine any more approaches	1
		Teacher training is still major problem	2
		Economic conditions have changed	2
Researchers	28	Diminished resources will prevent it	2
		Let new people come up with own exciting ideas	2
		New thrusts are required	6
		We are not following these programs any more	5
		Statement misses the real problem	1
		Most lacked a concern for all students	2
		Need more research into the process of logical thinking	2
		The strategies should differ greatly from those of the 60's	3
		More of the same is not needed	2
		If more inquiry discovery, etc., science will disintegrate even more	1
		New programs need to be for all students, not just the academically talented	1
		Must now include energy and technology, drastically different than during 60's	1

N = Number of Respondents
F = Frequency of Responses

C 3. NSF SUPPORT FOR TEACHER EDUCATION DURING 1959-79 RESULTED IN CHANGES IN TEACHER BEHAVIOR

TABLE C 3.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	78	84	52	53	30
disagree	6	6	28	38	50
neutral	16	10	20	9	20

GRAPH C 3.1 Graphic Presentation of Respondent Ratings

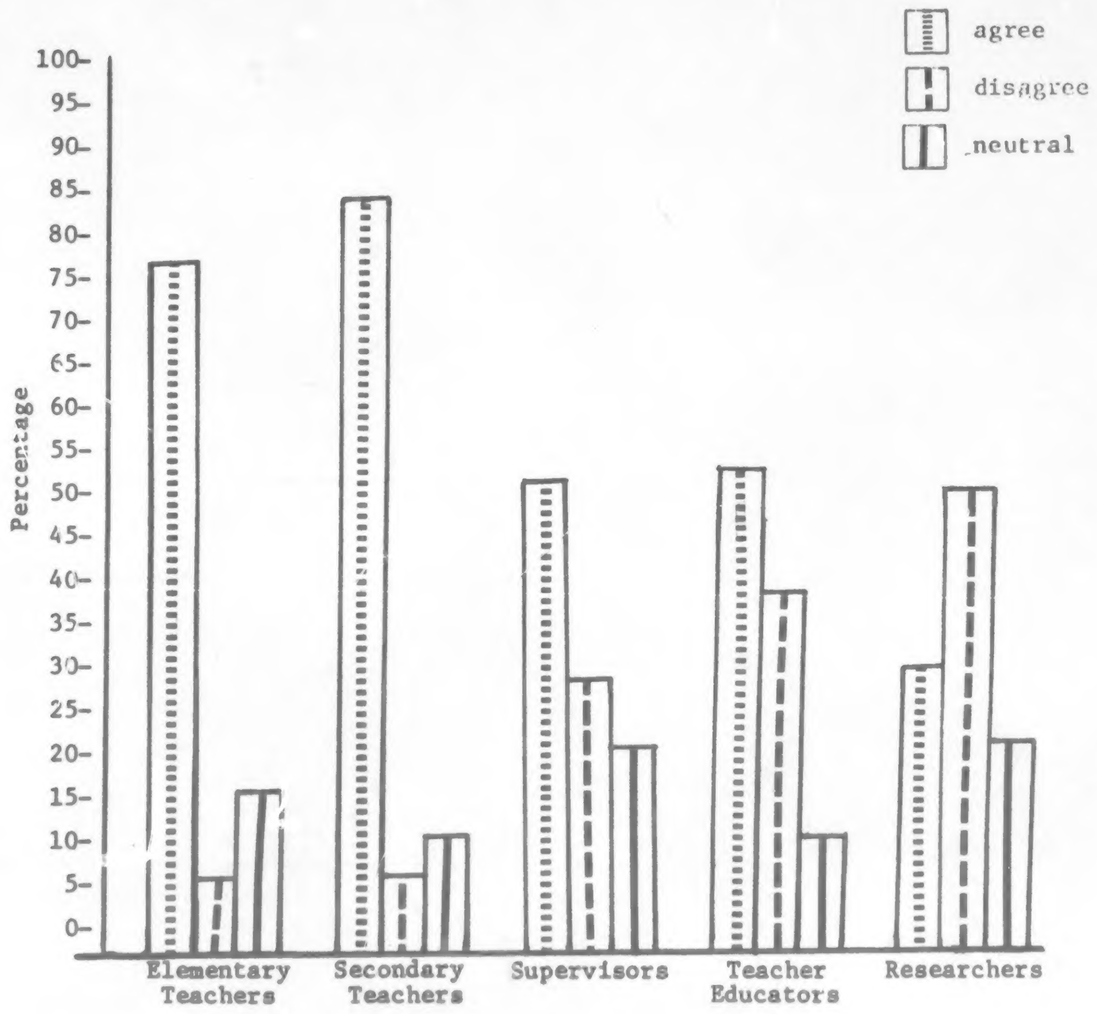
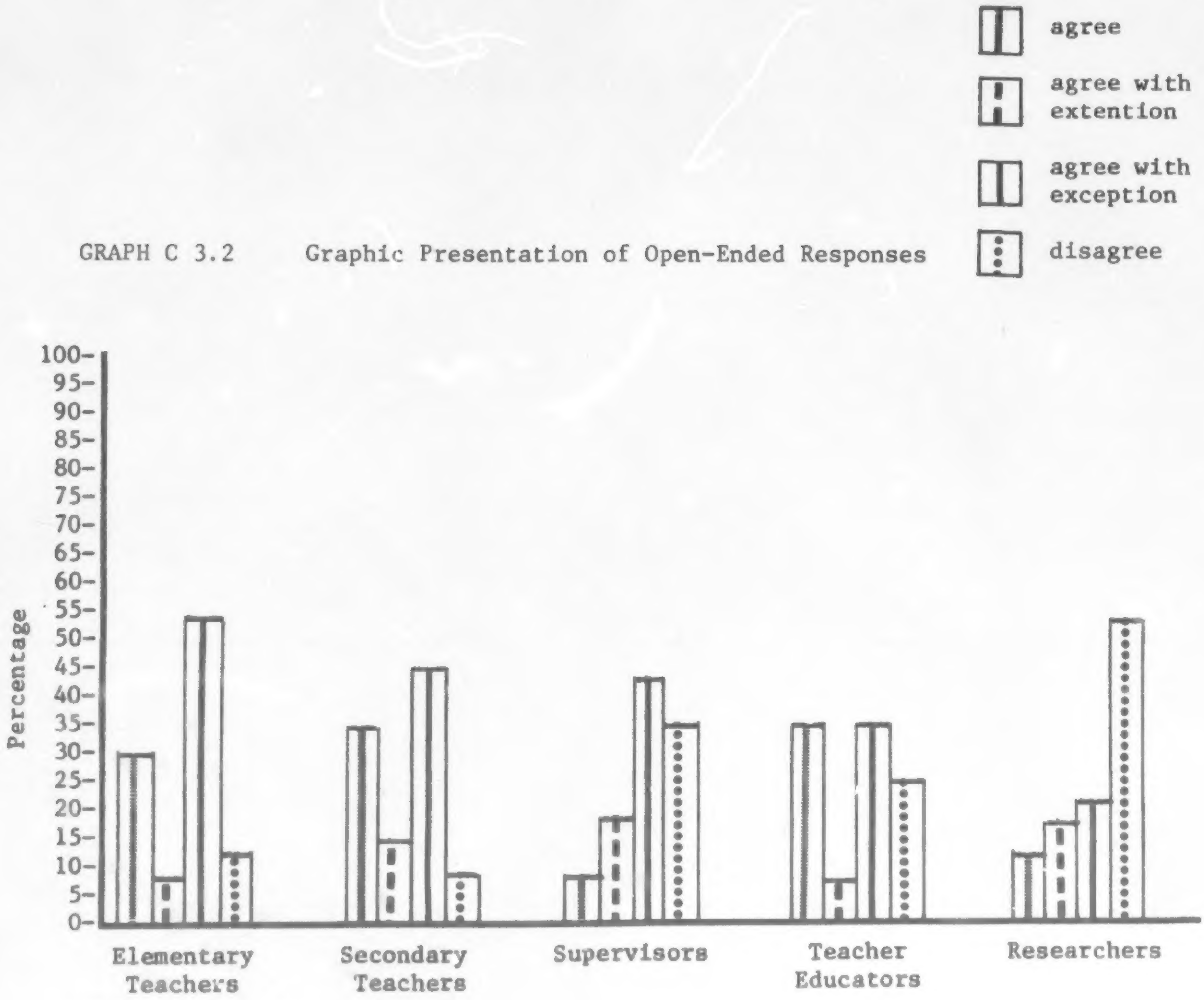


TABLE C 3.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	29	34	7	34	11
agree with extention	7	14	17	7	16
agree with exception	53	44	42	34	20
disagree	11	8	34	25	53

GRAPH C 3.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(45)	(64)	(59)	(61)	(56)

TABLE C 3.3 Tabulation of Open-Ended Responses Which Extend Position

Group	N	Summary of Responses	F
Elementary Teachers	3	Teacher behavior is difficult to change	3
Secondary Teachers	9	Need more since there are many new teachers concerned with science and teaching	3
		Support for teacher education is the key for the success of any program	6
Supervisors	10	A mix of teachers at institutes helped spread awareness	4
		Unfortunately these changes took teachers out of the teaching field	6
Teacher Educators	4	Most cost effective as change agent	4
Researchers	9	They had a significant impact on institutions	3
		Especially helped advance inquiry programs	3
		Particularly at the secondary level	3

N = Number of Respondents
F = Frequency of Responses

TABLE C 3.4 Tabulation of Open-Ended Responses Which Take Exception to Position

Group	N	Summary of Responses	F
Elementary Teachers	24	Only for those who already appreciated the importance of science anyway	2
		Encouraged only men	2
		Should have included more elementary teachers	13
		Only secondary teachers have changed	4
		The funding seems to run out	1
		Changes are only in the new teachers	3
Secondary Teachers	28	The improvements have slowed since 1972	4
		A few became "institute tramps" for pay	3
		Not "major" changes	3
		Question the value of NSF programs since 1969	2
		Most people still teach as they were taught	2
		Inquiry approaches never really implemented	4
		Stopped too soon	3
		Those that attended were those with least need	3
Supervisors	25	Need more inservice for elementary teachers	4
		In some cases only temporary changes	3
		Hardly major changes	2
		Affected only a few	3
		Should have been better balanced with methodologies dealing with specific programs	3
		Not since 1969	3
		Should be better job in screening applicants to prevent money being wasted	2
Teacher Educators	21	Did not change most participants	3
		Improvements were not major or long-lasting	5
		Only for those who participated and many did not	3
		There was a preoccupation with facts and content	4
		Not necessarily improvements	3
		Since no long-range follow-ups were done, difficult to evaluate	3
Researchers	11	The changes were short-term	3
		Needed to be more spread out for greater impact	2
		It is difficult to assess changes in behaviors	3
		But many changes not significant	3

N = Number of Respondents
F = Frequency of Responses

TABLE C 3.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	5	It still takes 50 years for a change in education	2
		So much "hands-on" that most elementary teachers could not accomplish much in time available	1
		Too few for elementary teachers	2
Secondary Teachers	5	Participants went back to business as usual	3
		The market was flooded with too many intellectuals and not enough laborers	2
Supervisors	20	It was a "give-away" program	4
		Much of NSF created new programs with old styles	3
		Most teachers have changed little	5
		Only allowed pursuance of advanced degrees	3
		Vast numbers of teachers were simply checked out on the use of the NSF programs	3
Teacher Educators	15	Three NSF studies indicate differently	2
		Too many people became dependent on support to continue their training and quit when funding stopped	3
		Did not work well with community and administrators who make the decisions	2
		Major attention was on curriculum (too specific)	3
		Change did not get to the classroom	4
		Figures give an overly optimistic picture	1
Researchers	30	Once external support was withdrawn teachers reverted back to their old behaviors	10
		Questionable because national assessment scores have declined	3
		Only for those who participated and most did not	4
		Not in any of the secondary classrooms	3
		The institutes that were designed to sell NSF programs were a disgrace and should not have been held	2
		Most directors did not stress changes in behaviors	6

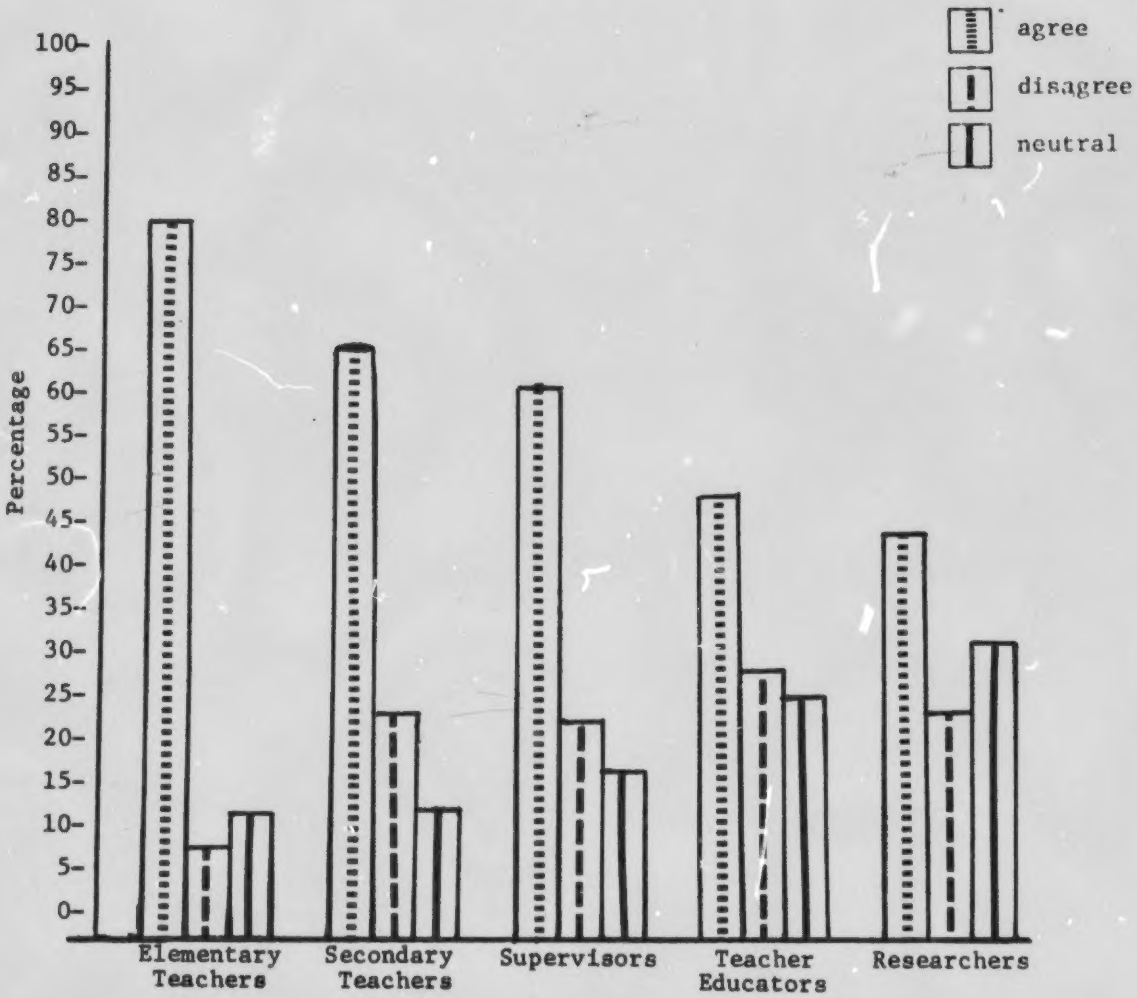
N = Number of Respondents
F = Frequency of Responses

C 4. MAJOR NEED FOR 80's IS FOR SCIENCE TEACHERS TO BE MORE KNOWLEDGEABLE ABOUT SPECIFIC STRATEGIES FOR MEETING GOALS

TABLE C 4.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	80	65	61	48	44
disagree	8	23	22	28	23
neutral	12	12	17	24	33

GRAPH C 4.1 Graphic Presentation of Respondent Ratings

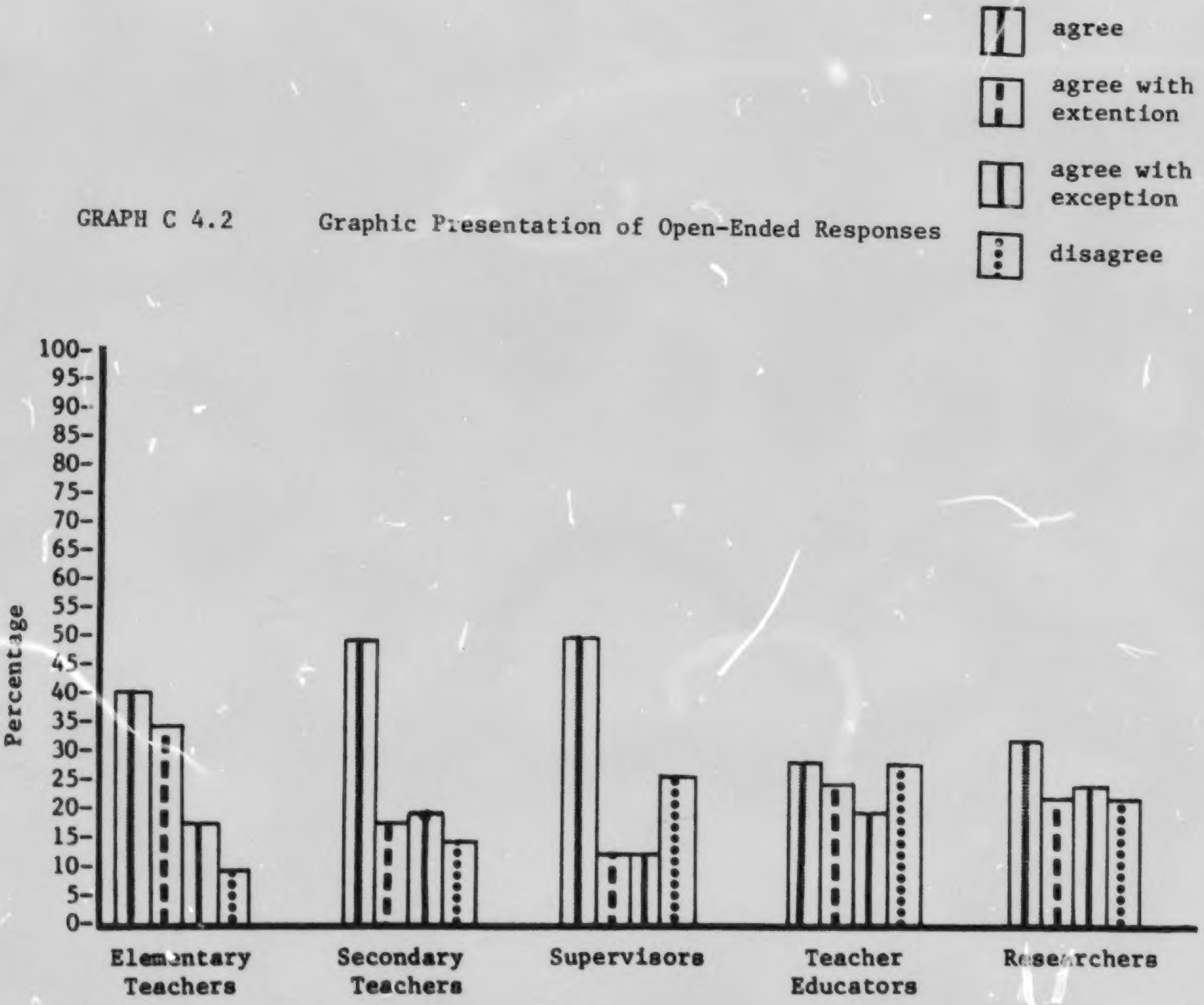


100

TABLE C 4.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	40	49	50	28	32
agree with extention	34	17	12	24	22
agree with exception	17	19	12	20	24
disagree	9	15	26	28	22

GRAPH C 4.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
(53)	(41)	(42)	(61)	(54)

TABLE C 4.3 Tabulation of Open-Ended Responses Which Extend Position

Group	N	Summary of Responses	F
Elementary Teachers	18	Strategies must also be developed for all students, not just those with exceptional interest and ability	4
		Best done by modeling	8
		Need more experience with "scientific methods" for better science teaching	3
		New strategies should help alleviate fear of science	3
Secondary Teachers	7	In order to teach students how to use knowledge, not just accumulate it	1
		By participating in more inservice seminars	1
		Need help especially in singling out the best approach	1
		Especially as we learn more about how the brain functions	1
		Especially since students seem to be changing	1
		And, how it is that students are affected by these strategies	1
		This is especially important since the initial strategy chosen by the teacher can turn a student off to science	1
Supervisors	5	Strategies based on increasing knowledge of how children learn	3
		New strategies must be supported by time and money	2
Teacher Educators	15	The ones that need emphasis are those which meet changing societal issues and values	4
		Teachers need to be more aware of research on learning	3
		Teachers need to know more about science	2
		These can best be done by NSF support for inservice for teachers	2
		There is a need for determining new goals	3
		Teaching is an intuitive process rather than a planned strategy	1
Researchers	12	These should be to help meet the needs of individual students	4
		These should integrate the sciences	3
		These should emphasize changing teacher behaviors	3
		Concepts as well as strategies	2

N = Number of Respondents
F = Frequency of Responses

TABLE C 4.4 Tabulation of Open-Ended Responses Which Take Exception to Position

Group	N	Summary of Responses	F
Elementary Teachers	9	Can not forget about district goals	1
		Approaches do not have to be new, teachers just need to feel successful with them	4
		Depends on the strategies, some are acceptable	2
		Sometimes the goals need changing	2
Secondary Teachers	8	Lack of knowledge is most common failing	6
		Although goals are often indefinite, there is little basis for choosing one strategy over another	2
Supervisors	5	What to teach is also important	2
		Teachers need to be updated in the content of science as well	2
		Only a need, not "the" need	1
Teacher Educators	12	Only if their goals reflect the NSTA 1964 statement	2
		The nature of science should be considered	2
		Science processes should be stressed	2
		Not skills of science	4
		Need to re-examine the goals first	2
Researchers	13	We need to examine goals as well	4
		Not "the" major goals	2
		Teachers also need to understand the content	3
		We really need to implement old strategies better	2
		The approaches need to be based on sound research	2

N = Number of Respondents
F = Frequency of Responses

TABLE C 4.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	5	The major need is to get rid of incompetent teachers	3
		Need practice in using the strategies	2
Secondary Teachers	6	Teachers need to know more science	4
		First need is for more teacher-developed programs	2
Supervisors	11	Greatest need is to know more content	3
		Need to develop the goals first	4
		Need to know more about learning theory	3
		Teaching does not change much	2
		Need to teach toward specific objectives	2
Teacher Educators	17	The major need is for goal clarification	7
		Teachers need better content backgrounds	3
		Need a clearer understanding of ways children learn	3
		Administrative structure hinders teachers	2
		Need more teachers with personal conviction and sense of purpose	3
Researchers	12	We should replace teachers who are ineffective	4
		Too much a behavioral view of teaching; we need to ask what it means to be a science teacher	3
		Teachers must know the up-to-date content	1
		Teachers need to reconsider goals, then work on strategies to meet them	4

N = Number of Respondents
F = Frequency of Responses

C 5. CHANGES IN U.S. POPULATION REPRESENT MAJOR CONCERNS FOR SCIENCE TEACHING IN 1980

TABLE C 5.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	56	63	61	48	44
disagree	25	23	22	28	23
neutral	19	14	17	24	33

GRAPH C 5.1 Graphic Presentation of Respondent Ratings

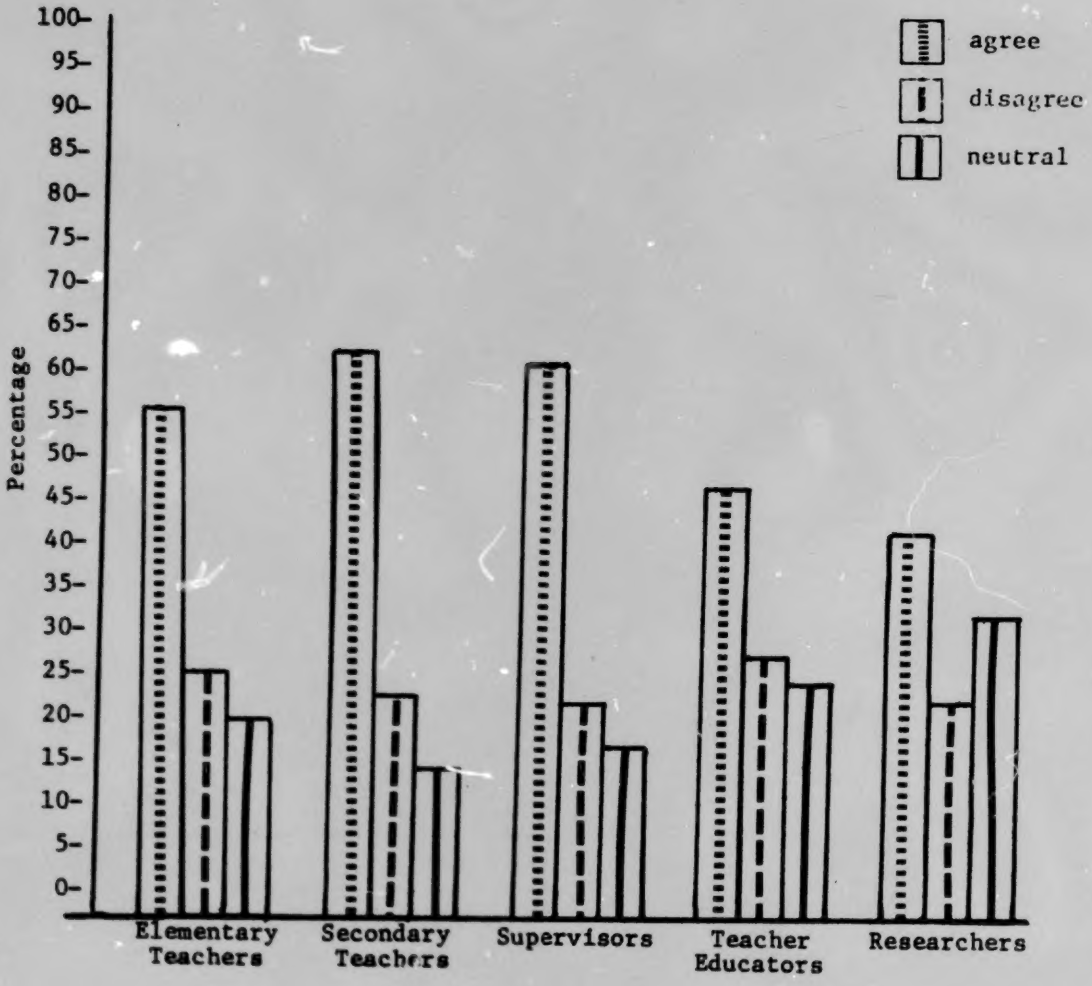
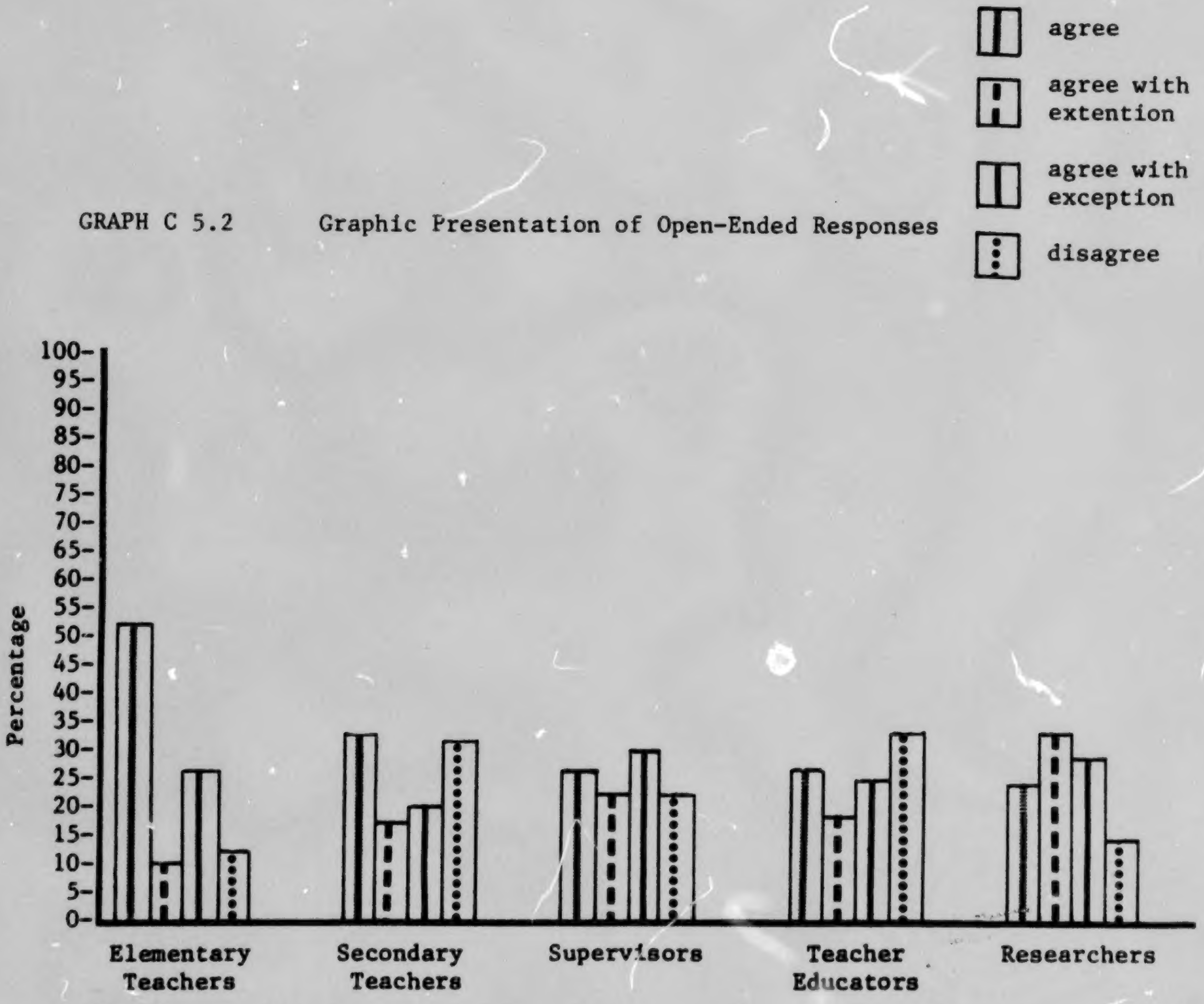


TABLE C 5.2 Categorization of Open-Ended Responses*

		Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
Percentage	agree	52	32	26	26	24
	agree with extention	10	17	22	18	33
	agree with exception	26	20	30	24	29
	disagree	12	31	22	32	14

GRAPH C 5.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(42)	(59)	(50)	(50)	(51)

TABLE C 5.3 Tabulation of Open-Ended Responses Which Extend Position

Group	N	Summary of Responses	F
Elementary Teachers	4	Educators must convince the public that science education is worth it	4
Secondary Teachers	10	Instability and financial concerns will distract from good teaching	2
		Inclusion of non-English speaking groups	2
		Declining enrollments will affect number of teaching positions	6
Supervisors	11	Funding trends follow population trends	2
		Science courses at the secondary level will be curtailed	3
		Supply of new science teachers will be curtailed and stagnation will occur	6
Teacher Educators	9	Especially as it relates to funding	5
		Because tenured teachers are being shifted into positions for which they are not qualified	2
		Stable faculties can be a disaster	2
Researchers	17	We need more research on teacher turnover rates	3
		Little turnover among teachers means fewer new ideas	3
		Money is tied to bodies	4
		The "culturally different" segment is growing	4
		Teachers will have to change comfortable ways	3

N = Number of Respondents
F = Frequency of Responses

TABLE C 5.4 Tabulation of Open-Ended Responses Which Take Exception to Position

Group	N	Summary of Responses	F
Elementary Teachers	11	This is a concern primarily for the social sciences	6
		This affects all of education	5
Secondary Teachers	12	Will lead to stability and not stagnation	3
		Even though classes may be smaller, teaching today is harder	3
		Only insofar as teaching jobs are concerned	4
		This is true for all subjects	2
Supervisors	15	The basic needs will remain	3
		Is true for all of education	6
		Nothing we can do about it	3
		Only part of the problem because we really need to put science back in a position of importance	3
Teacher Educators	12	Not just in science teaching	3
		Not a major area of concern	6
		A reduction should not affect science teaching	3
Researchers	15	Not "the"; just a major area of concern	2
		No direct effect unless class size is involved	3
		Not if science were considered a basic skill	2
		Not specific to science	2
		The emphasis should be on quality regardless of numbers	4
		Only to the extent that the training and production of teachers will have to be "keyed" to their trends	2

108

N = Number of Respondents
F = Frequency of Responses

TABLE C 5.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	5	It should not be	3
		It could help by lowering class size	2
Secondary Teachers	18	Demographics should not have any effect	4
		As populations drop, science must be more attractive as it competes for students	2
		Quality should have a chance to improve as quantity declines	6
		As long as science classes are populated above 25, we will need teachers	4
		Science can be taught to a large group or individually, best depending on teacher effectiveness	2
Supervisors	11	Can not do anything about it	5
		A gain if incompetent teachers are lost	2
		Could enable us to meet goal of personalized instruction	2
		Making science relevant could negate this concern	2
Teacher Educators	16	Other concerns will be higher in priority	2
		Our job is to do a better job with those who are taking science and attract those who are not .	4
		Could be an opportunity to improve things	3
		Only need to convince the public to support lower class size	2
		Need to require more science at the secondary level	2
		This is an insignificant problem	4
Researchers	7	Population appears to be stabilizing inthe U.S.	3
		Not a major concern	4

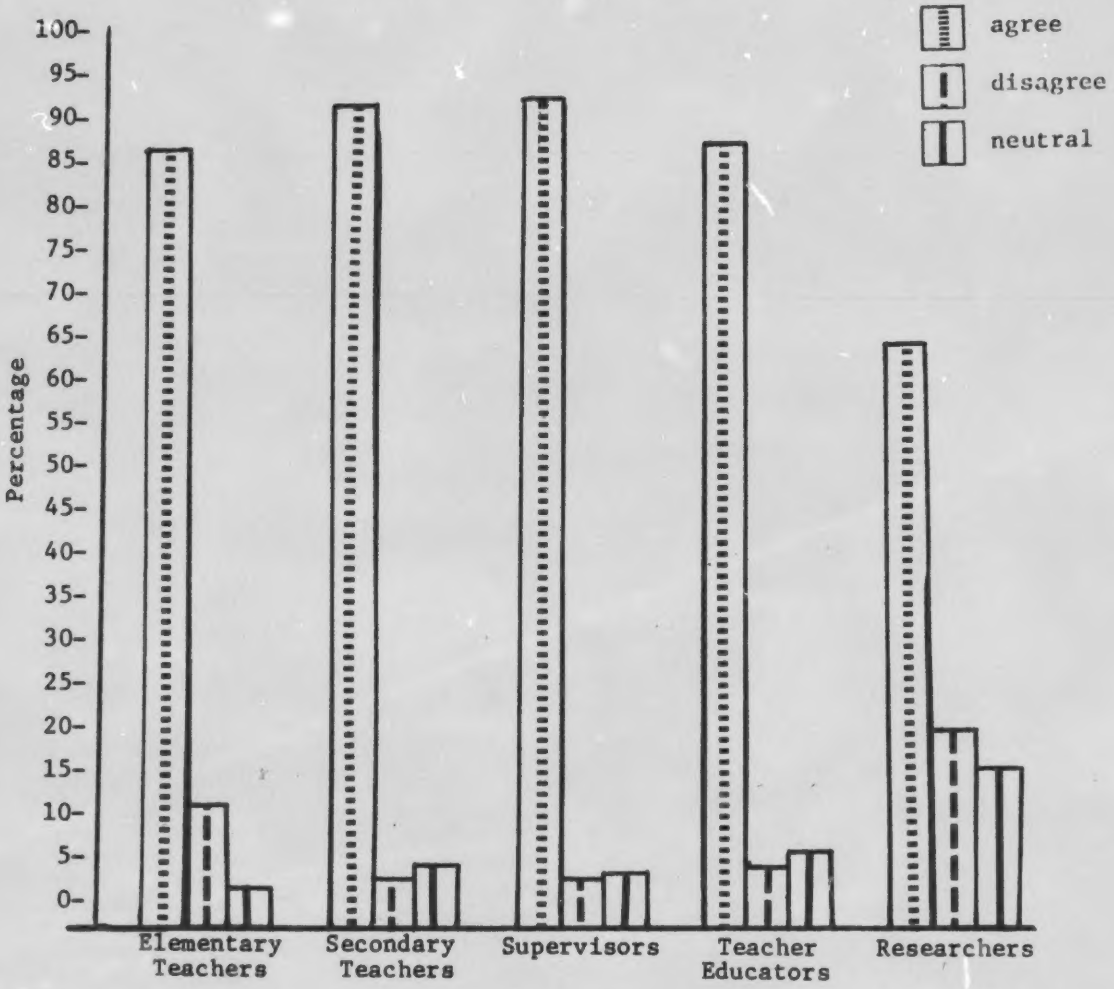
N = Number of Respondents
F = Frequency of Responses

C 6. DECLINE IN FUNDS FOR SCIENCE EDUCATION IS MAJOR CONCERN FOR THE 80's

TABLE C 6.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	87	92	93	88	65
disagree	11	3	3	5	20
neutral	2	5	4	7	15

GRAPH C 6.1 Graphic Presentation of Respondent Ratings



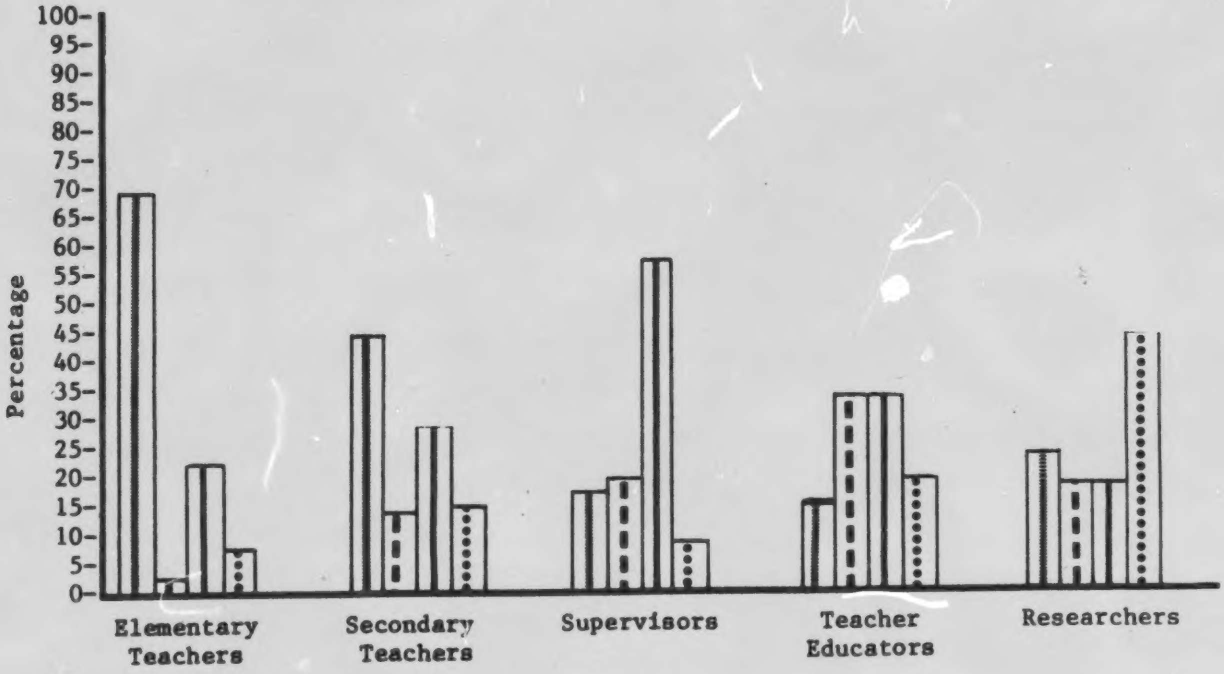
110

TABLE C 6.2 Categorization of Open-Ended Responses*

		Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
Percentage	agree	69	44	16	15	22
	agree with extention	2	13	19	33	17
	agree with exception	22	28	57	33	17
	disagree	7	15	8	19	44

GRAPH C 6.2 Graphic Presentation of Open-Ended Responses

▥ agree
▥ agree with extention
▥ agree with exception
⁝ disagree



*Numbers Providing Responses

(55)	(61)	(37)	(42)	(36)

TABLE C 6.3 Tabulation of Open-Ended Responses Which Extend Position

Group	N	Summary of Responses	F
Elementary Teachers	1	Need to add to that "the science supervisor"	1
Secondary Teachers	8	Support should be sought in areas concerned with energy and environmental issues	4
		Since fewer people will be going into science teaching, there will be fewer models for students	4
Supervisors	7	There are too many teachers in the classrooms who were not able to profit from NSF programs	4
		Particularly in the area of pre-service training	3
Teacher Educators	14	Funding which is available should be directed toward attitudes and strategies rather than curriculum	4
		Need more emphasis on implementation of new programs	4
		Must "sell" the idea that science is basic	6
Researchers	6	Probably aggravated because money has to be spent for programs with clear objectives but no research or evaluation	3
		Especially for curriculum designed with local teachers	3

112

N = Number of Respondents
F = Frequency of Responses

TABLE C 6.4 Tabulation of Open-Ended Responses Which Take Exception to Position

Group	N	Summary of Responses	F
Elementary Teachers	12	The teacher is more important than the money	4
		Much money is wasted because it's spent on unneeded expensive equipment	4
		It is still possible to teach science without a wealth of materials	2
		If certain basics are decided on, it can continue satisfactorily	2
Secondary Teachers	17	A greater concern is the importance placed on science by population and government	6
		Teachers need more work in strategies area	3
		Better use of the money available needs to be made	3
		Money must come from local agencies	3
		Disagree the 50's and 60's are a thing of the past	2
Supervisors	21	The tone of this section is too pessimistic	3
		Science education needs to turn toward the general student	4
		Money should be allocated to systems and not higher education	3
		Some new programs may come out of the previously developed ones	2
		There has been waste in previous expenditures	5
		We are at the mercy of the public and politicians	2
		It relegates science to a lower priority	2
Teacher Educators	14	More money is not the answer, it's how it is used	4
		The major concern is the loss of public support	3
		The government can not be expected to solve all our problems	3
		The priorities are all wrong; labs should come first	2
		When it is the major concern,it becomes an excuse for maintaining the status quo	2
Researchers	6	Money is only one factor	2
		Especially for research to improve teaching	4

N = Number of Respondents
F = Frequency of Responses

TABLE C 6.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	4	Just a balancing of funds for the total curriculum	2
		Money spent at the national level does not affect kids in classroom	2
Secondary Teachers	9	Seems like finding someone or something to blame for lack of accomplishments	3
		Creativity is improved when budgets are low	2
Supervisors	3	Good teaching takes no more money than bad teaching	3
Teacher Educators	8	Funding should be supplementary not the prime mover	2
		Funding not used to promote long-lasting changes	2
		Local dollars do more good	1
		Will have to live with whatever exists	1
		If there were fresh leadership, the money would be there	2
		More money will not necessarily change attitudes	2
Researchers	16	The current funding level is only window dressing	2
		The real decline is in the degree to which science education is perceived to be relevant	3
		Should not be dependent on funding for better teaching	3
		Need to seek out other sources of funding	2
		Been spoiled by excessive spending in past	3
		Less money means more creativity	1
		It is not level of funding, but knowing what to do with what there is	2

N = Number of Respondents
F = Frequency of Responses

C 7. THE DECLINE IN NUMBERS OF STUDENTS IN SCIENCE CLASSES IS A MAJOR CAUSE FOR ALARM IN 1980

TABLE C 7.1 Result of Respondent Ratings

		Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
Percentage	agree	70	76	76	66	60
	disagree	15	15	13	24	28
	neutral	15	9	11	10	12

GRAPH C 7.1 Graphic Presentation of Respondent Ratings

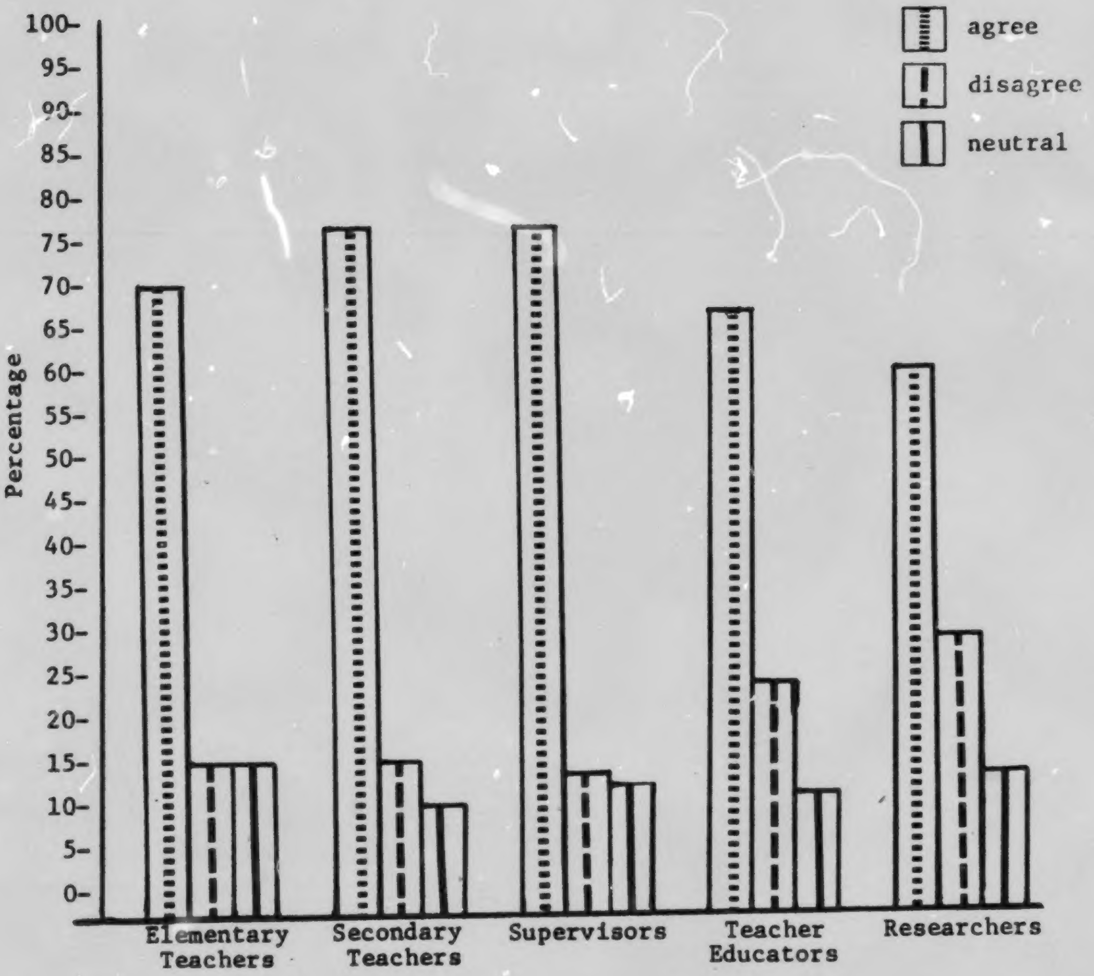
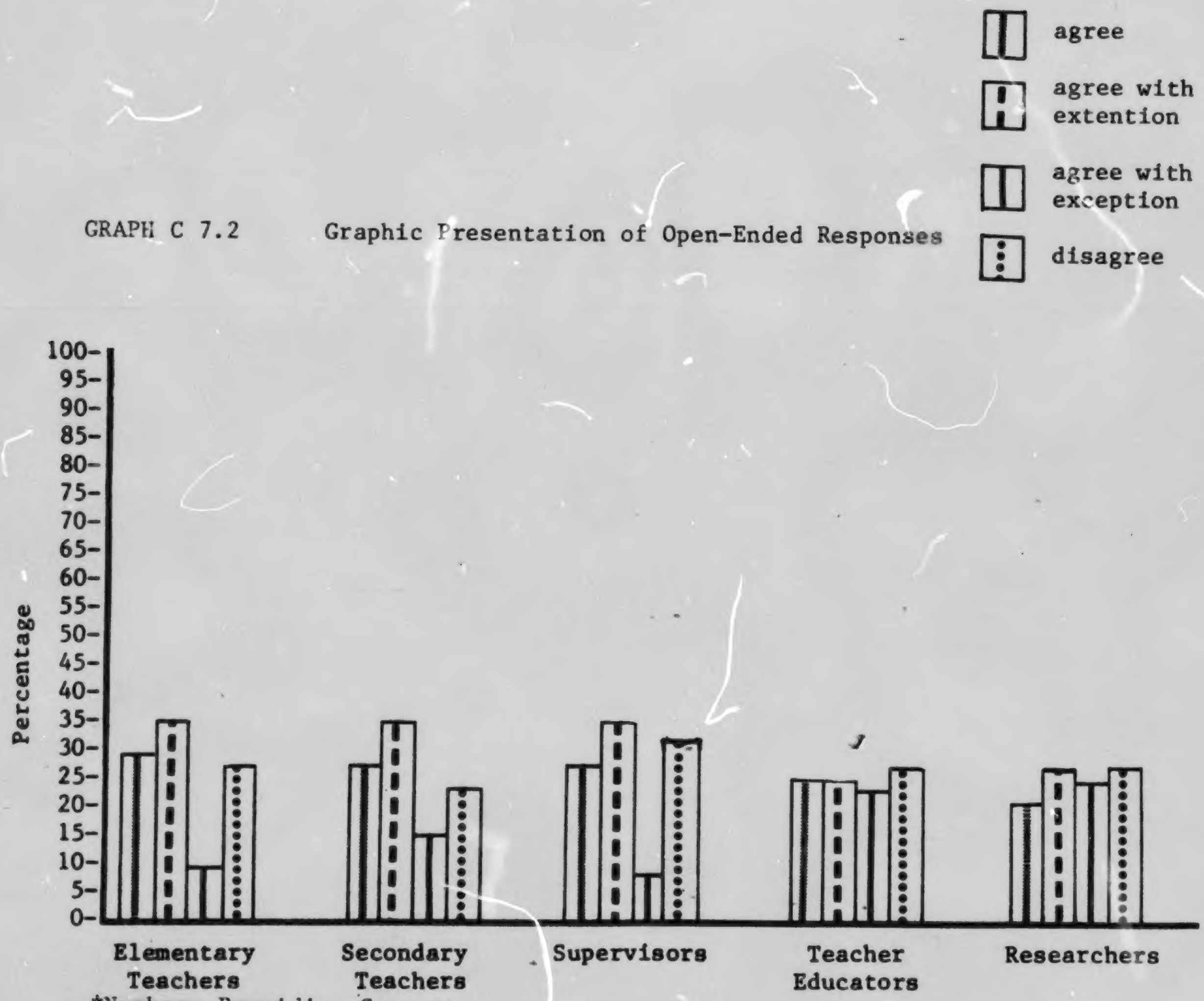


TABLE C 7.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	29	27	26	25	21
agree with extention	35	35	35	25	27
agree with exception	9	15	8	23	25
disagree	27	23	31	27	27

GRAPH C 7.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(52)	(60)	(49)	(60)	(48)

TABLE C 7.3 Tabulation of Open-Ended Responses Which Extend Position

Group	N	Summary of Responses	F
Elementary Teachers	18	We will lose some excellent science teachers	3
		Too little science is being required	3
		Due to poor or non-existent science programs in the elementary schools	4
		Demonstrates need for new curricula	2
		Especially in the secondary schools	6
Secondary Teachers	21	Because students want to work instead	3
		Gives us a chance to be innovative	3
		Need to require minimum number of science courses	3
		Because courses have turned students off	4
		Lack of direction in subject matter	2
		Not a part of the back to basics movement	3
		Anti-science attitudes	3
Supervisors	17	Must increase credibility of science as a basic	4
		Because of dissatisfaction of top college science students	3
		Parents do not want students exposed to "science ideas"	3
		Programs are perceived as too difficult and not relevant	3
		Because once science population declines it will be impossible to recruit good teachers	2
		Decrease in elective courses	2
Teacher Educators	15	Need to look at science instruction, it reflects how well science teachers prepared and sold their courses	4
		Need for science teachers to make courses interesting and relevant	4
		Need to require more science	3
		Because have allowed others to tell us what to teach	2
		Reflects attitude toward science in general	1
		Because arts and science faculties are elitists	1
Researchers	13	Suggests we are not emphasizing what's important to students	3
		Because courses are not tough enough	2
		There is loss of confidence in importance and value of science	2
		Can only correct problem at elementary level	3
		Back to basics is hurting	3

N = Number of Respondents
F = Frequency of Responses

TABLE C 7.4 Tabulation of Open-Ended Responses Which Take Exception to Position

Group	N	Summary of Responses	F
Elementary Teachers	5	May not be a cause for serious alarm	4
		Only in science courses, not teacher education	1
Secondary Teachers	9	Not cause for alarm-only concern	2
		Should be looking at percentages	3
		Only if we want everyone to be scientists	2
		We are still producing adequate numbers of science majors	2
Supervisors	4	A lot of teachers need to change and make their courses more attractive	4
Teacher Educators	14	Only as it holds true for other academic areas	3
		Still getting quality	3
		Not significant for what teachers do	2
		Only if percentage decreases	3
		May not be a major concern	2
		It is a symptom of other things	1
Researchers	12	Should be focusing on quality	3
		The greater concern is declining enrollments in teacher education	2
		We need to do a better job with the current population of students	3
		Only to the extent that budgets will be limited	2

N = Number of Respondents
F = Frequency of Responses

TABLE C 7.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	14	Numbers do not indicate a decline	3
		Quality has not declined so no problem	3
		We just need to stiffen courses so students can gain recognition rewards for being good in science again	3
		Decline only in terms of length of time for science activities	5
Secondary Teachers	14	Could allow us more time for individualization	2
		Do not experience this problem	4
		We should be pleased	2
		More concerned about decline in quality	3
		Students are electing hard sciences again	3
Supervisors	15	Should only be concerned about improving percentage science gets	3
		Teachers only have to do a good job	2
		Shortages of scientists will reverse trend	2
		Have not experienced declines	5
		Have to live with it	2
		Enrollments are actually up	1
Teacher Educators	16	Not a "primary" cause for concern	4
		Need to forget numbers and face challenges of students who are there	3
		Only if we consider K-College students as our populations	3
		Maybe a good thing if teaching poorly done	2
		Decline has bottomed out	2
		New curricula could be offered to favor students	2
Researchers	13	Not a primary cause for alarm	4
		Basic science is not necessary for many students	3
		All students need to be reached; actual enrollment in a given school is not a science education concern	6

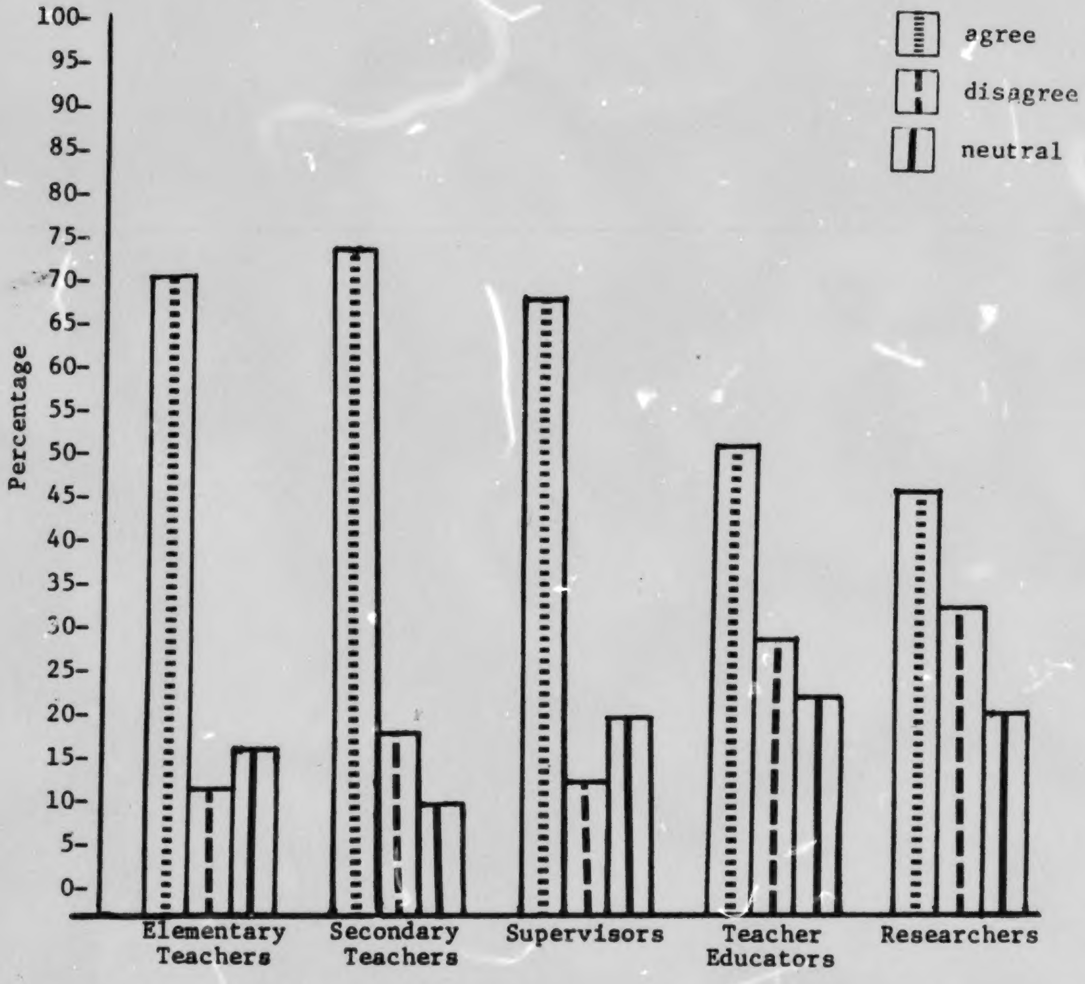
N = Number of Respondents
F = Frequency of Responses

C 8. ACCOUNTABILITY AND COMPETENCY-BASED PROGRAMS REPRESENT MAJOR CONCERNS TO SCIENCE EDUCATION FOR THE 80's

TABLE C 8.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	71	73	68	51	48
disagree	12	18	12	28	33
neutral	17	9	20	21	19

GRAPH C 8.1 Graphic Presentation of Respondent Ratings

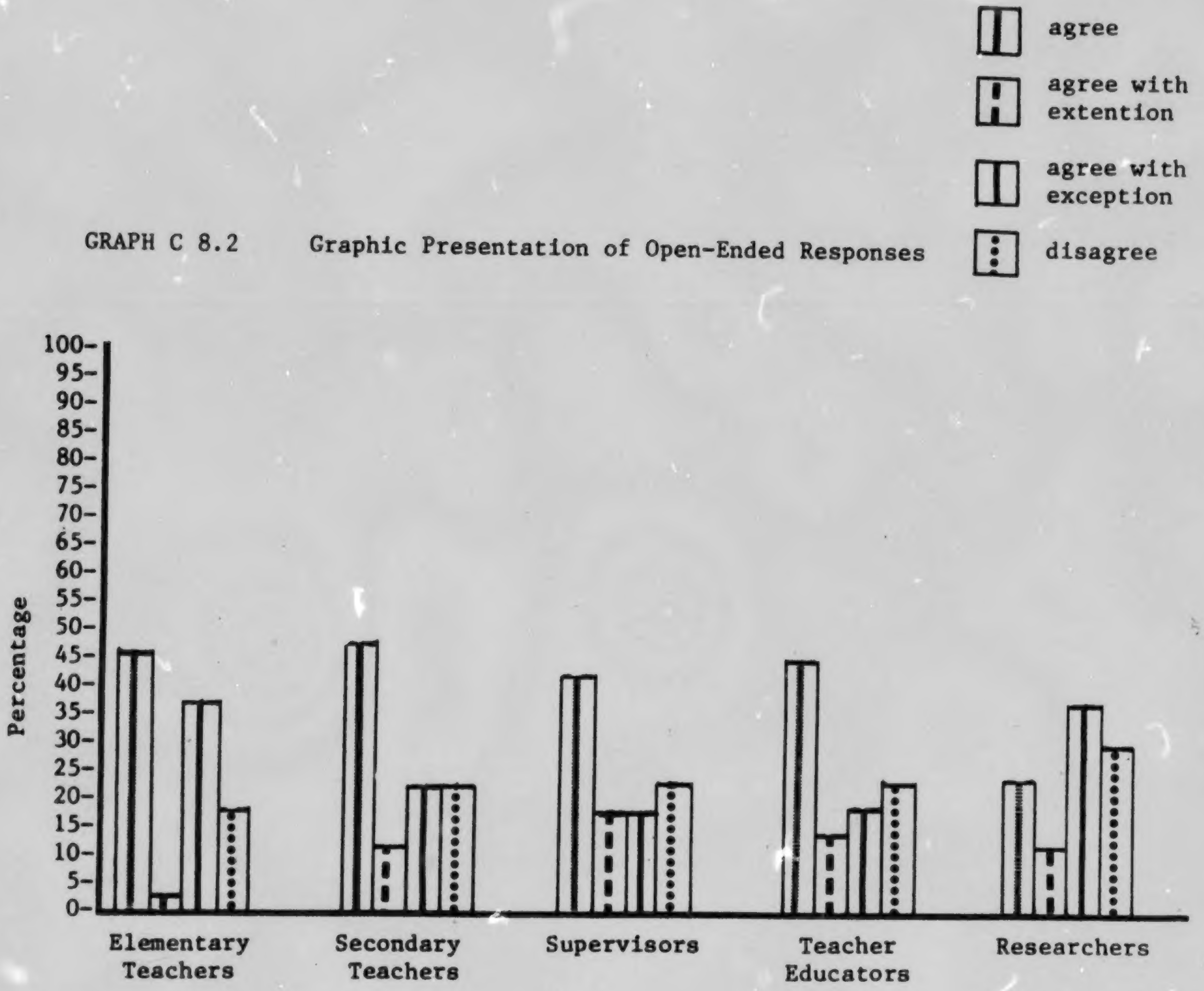


120

TABLE C 8.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	45	47	41	45	24
agree with extention	2	11	18	14	11
agree with exception	36	21	18	18	36
disagree	17	21	23	23	29

GRAPH C 8.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
(42)	(56)	(51)	(49)	(55)

TABLE C 8.3 Tabulation of Open-Ended Responses Which Extend Position

Group	N	Summary of Responses	F
Elementary Teachers	1	Standards need to be defined by each local district	1
Secondary Teachers	6	Competency-based programs will cause teachers to refuse to teach unsuccessful students	3
		Need to move to such programs before forced upon us	3
Supervisors	9	We must make an effort to define difference between science skills and content and the evaluation techniques for each	3
		Must find evaluation techniques beyond multiple choice tests	2
		With accountability might come adequate support	3
		How else can Science Education compete for taxpayer's dollar	1
Teacher Educators	7	The major question is who decides for what we will be held accountable	2
		Mainly because we do not know how to handle these issues	2
		Because the science community can not agree as to what is necessary	1
		Only if we can include values and attitudes when instituted prematurely	1
		Because these are technological and considered to be scientific when really not	1
Researchers	6	Because it will tend to push science away from values, attitudes	2
		Causes us to focus on trivial and trite	4

N = Number of Respondents
F = Frequency of Responses

TABLE C 8.4 Tabulation of Open-Ended Responses Which Take Exception to Position

Group	N	Summary of Responses	F
Elementary Teachers	15	Only if accountability is also applied to students	4
		Only accountability and not competency-based programs	3
		Not with standardized tests and competency-based programs	4
		Not in some school districts where it is of no concern at all	4
Secondary Teachers	12	Should not hinder the curriculum needed for the 80's	4
		Not easily integrated into most districts	3
		Paper work should be minimized	3
		Should not become "means" of teaching	2
Supervisors	9	Too often placed on teacher and not on student	2
		If science is included as a basic	3
		Such movements do not dictate content	4
Teacher Educators	9	Not if they disguise the deeper need to understand how children learn	1
		Only if they achieve goal of improving education	2
		Is a concern only regionally	1
		Need to get meaningful definitions on these concepts rather than exhibit alarm	2
		Proponents do not know what students need	3
Researchers	20	Could move science into the memory mode and kill inquiry	2
		Proves disastrous for bright kids	3
		Will not measure the development of attitudes	2
		Clear definition of goals does not mean the learning will be better	3
		If measures skills, processes and problem-solving, then no problems	2
		When you focus on accountability for competency, you lose both	4
		Too narrowly expressed	2

N = Number of Respondents
F = Frequency of Responses

TABLE C 8.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	7	Elementary teachers have very little accountability in-service	4
		Instruments for accurate measurement are not available	3
Secondary Teachers	12	Not worth effort and energy - too many problems	3
		Not problem if teachers are doing job	1
		Passing fad	4
		Not a problem for science if procedures specified correctly	2
		Concern only for taxpayers	2
Supervisors	12	This movement tends to emphasize only the three R's	2
		Can not be implemented	3
		No problem for competent teacher	2
		It is a fad	3
		Need only to prepare and present arguments ahead of time	2
Teacher Educators	11	It does not allow poor teaching	3
		Is diminishing or will pass	7
		Has nothing to do with science teaching	1
Researchers	16	A phenomenon of the past	6
		Not appropriate for science; perhaps for spelling and arithmatic skills	4
		Ridiculous ideas from the start	4
		Need to police professions ourselves	2

N = Number of Respondents
F = Frequency of Responses

C 9. SCHOOL STUDENTS ARE VASTLY DIFFERENT TODAY WHICH REPRESENTS A MAJOR CONCERN FOR SCIENCE TEACHING FOR THE 80'S

TABLE C 9.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	79	65	49	48	42
disagree	15	21	29	36	38
neutral	6	14	22	16	20

GRAPH C 9.1 Graphic Presentation of Respondent Ratings

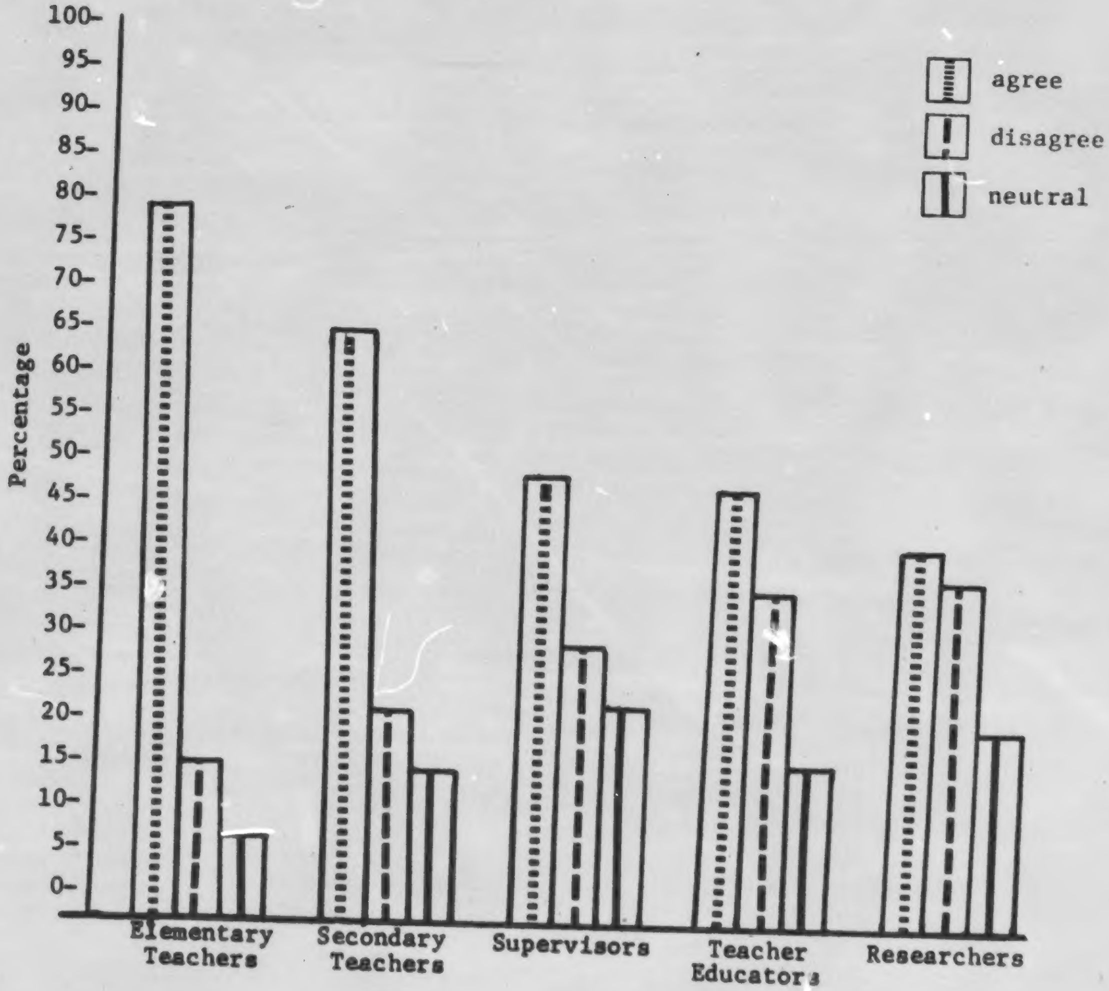
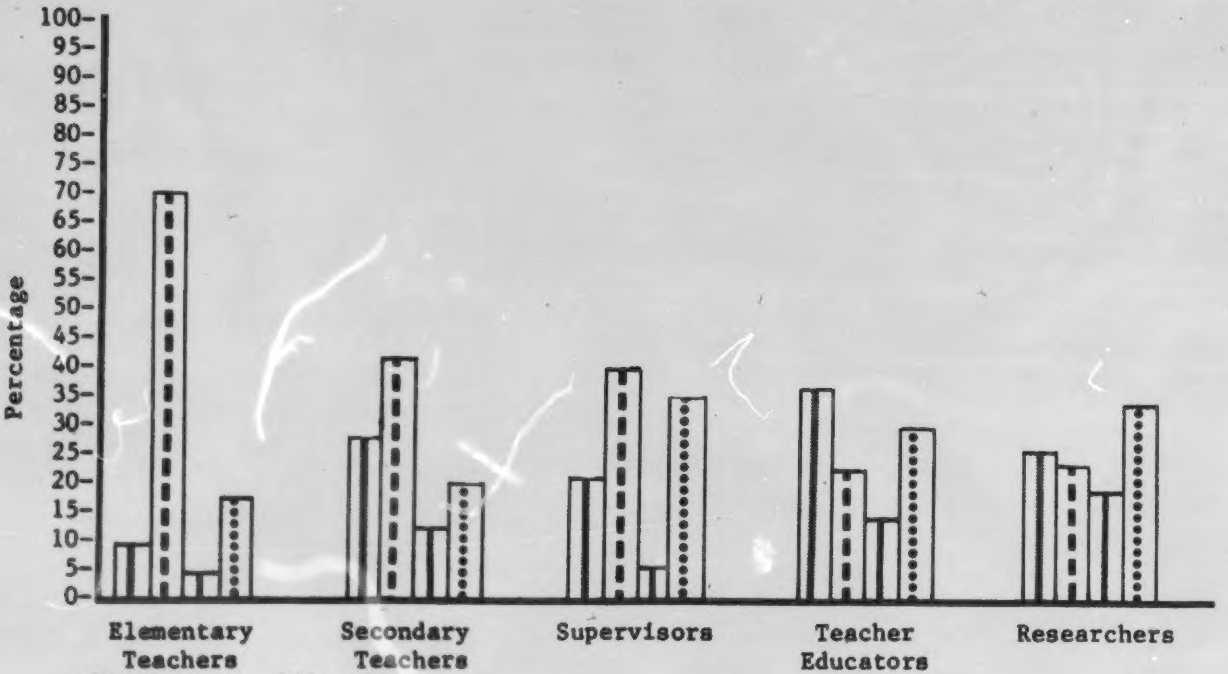


TABLE C 9.2 Categorization of Open-Ended Responses*

		Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
Percentage	agree	9	27	21	36	26
	agree with extention	70	41	39	22	23
	agree with exception	4	12	5	13	18
	disagree	17	20	35	29	33

GRAPH C 9.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(54)	(59)	(43)	(55)	(39)

TABLE C 9.3 Tabulation of Open-Ended Responses Which Extend Position

Group	N	Summary of Responses	F
Elementary Teachers	38	Because home, society and TV have created problems	6
		More worldly	2
		Affected by the environment	1
		Have more knowledge	2
		More diverse	3
		Less motivated	2
		General negative attitude	3
		Want quick answers	1
		Not task oriented	2
		More mature	7
		Have fewer taboo topics	6
		More serious	3
Secondary Teachers	24	More goal oriented	3
		Better informed	2
		Because society has changed	3
		More visually oriented	2
		Not as curious	1
		Have new priorities	2
		More sophisticated	2
		Because they have a declining respect for teachers	2
		Lack of motivation	3
		Lack of self-discipline	4
Supervisors	17	Because they are lazy and apathetic	5
		Lack of reading skills	1
		Permissive society	3
		Better trained in science	1
		More oriented toward value issues	2
		Society has changed	5
Teacher Educators	12	Motivation is vanishing	3
		More intelligent, more mature	2
		Frequent changes in career goals	3
		More looking for a purposeful life	2
		Lack of control and self-discipline	2
Researchers	9	Percentage staying in school has increased	2
		Feel less authority in school administration	3
		Effected by societal problems	4

N = Number of Respondents
F = Frequency of Responses

TABLE C 9.4 Tabulation of Open-Ended Responses Which Take Exception to Position

Group	N	Summary of Responses	F
Elementary Teachers	2	It may not be the student but what he/she is required to do	2
Secondary Teachers	7	Only because of new waves of immigrants	2
		Only because they are subjected to lesser expectation	3
		Shows need to individualize	2
Supervisors	2	While there are differences the big ideas remain the same	1
		This is true of every age	1
Teacher Educators	7	We still have a small hard-core group that is still the same	3
		Genetically, no; environmentally, yes	2
		So is everyone	2
Researchers	7	Teachers are the cause in many cases	2
		Only because we are trying to make all of them go to college	3
		Different in some ways but not in others	2

N = Number of Respondents
F = Frequency of Responses

TABLE C 9.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	9	Not vastly different	2
		Kids are the same	4
		Problem is that we have lowered our standards to accommodate racial pressures	3
Secondary Teachers	12	Not vastly different	6
		Students are students	3
		The problem is not that the students are different but the schools are not	3
Supervisors	15	Not vastly different	7
		Kids are the same	5
		Expectations have decreased, so has student ability	3
Teacher Educators	16	Not vastly different	6
		Kids are the same	6
		No evidence	4
Researchers	13	Not vastly different	6
		Kids are the same	7

N = Number of Respondents
F = Frequency of Responses

C 10. TEACHER UNIONIZATION IS A MAJOR CHANGE AND A CONCERN FOR SCIENCE INSTRUCTION FOR THE 80'S

TABLE C 10.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	29	26	40	34	37
disagree	29	46	36	49	38
neutral	42	28	24	17	25

GRAPH C 10.1 Graphic Presentation of Respondent Ratings

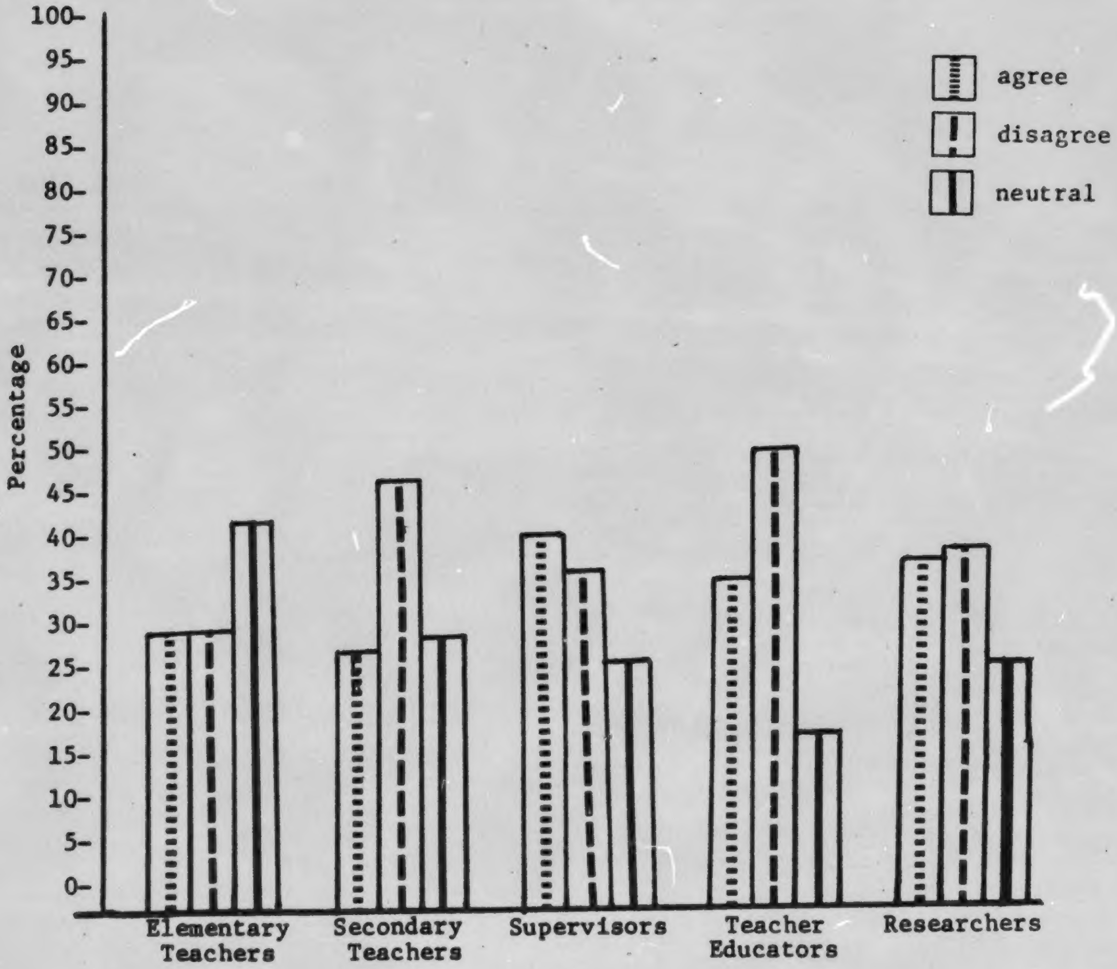
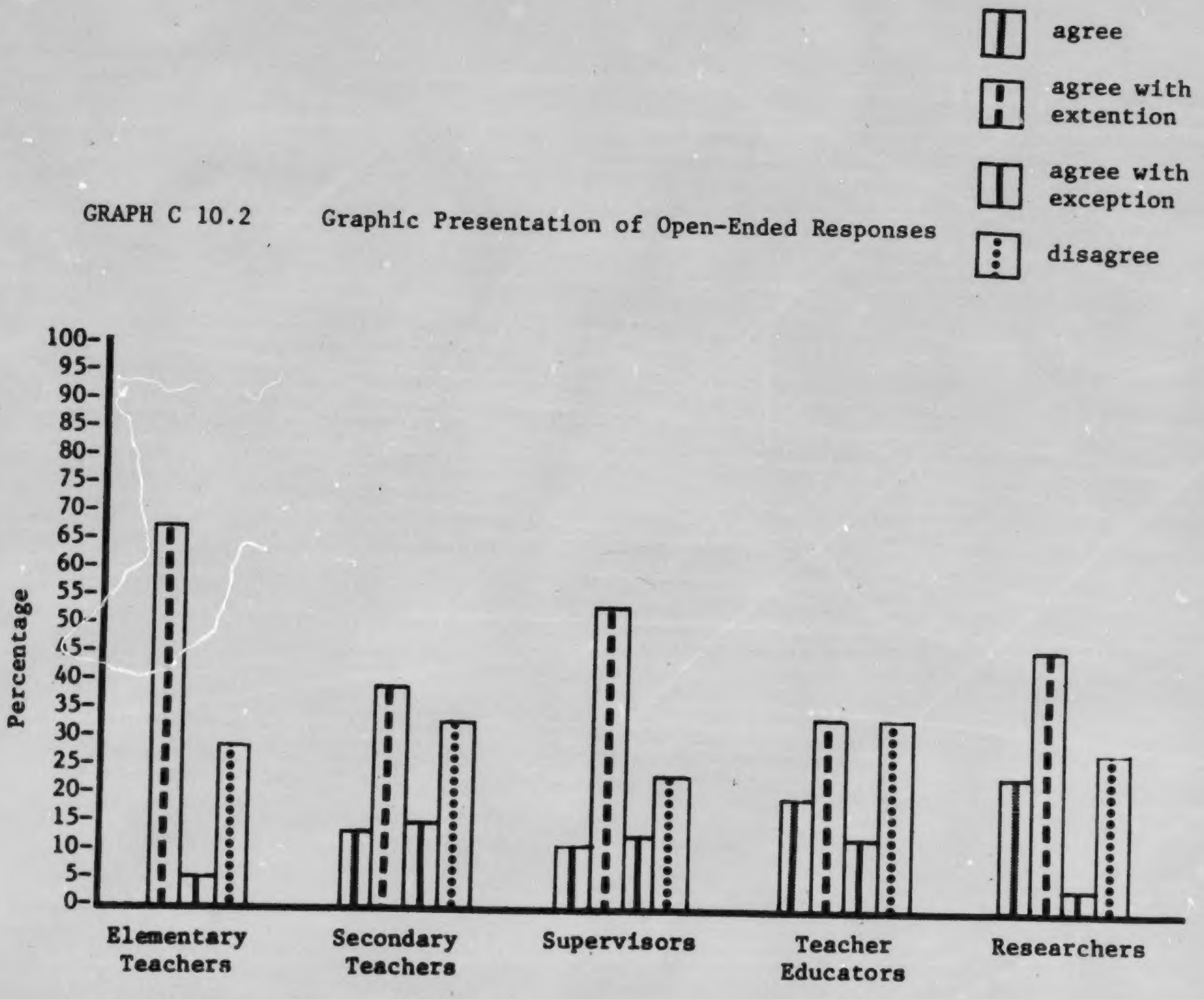


TABLE C 10.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	0	13	11	19	23
agree with extention	67	39	53	34	46
agree with exception	5	15	13	13	3
disagree	28	33	23	34	28

GRAPH C 10.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(43) (46) (47) (59) (35)

TABLE C 10.3 Tabulation of Open-Ended Responses Which Extend Position

Group	N	Summary of Responses	F
Elementary Teachers	29	Help working conditions	3
		Protection for teachers	3
		Work for teachers, e.g., provide help	2
		Work for better staffing and programs	3
		Good as long as they don't get out of hand	2
		Science locked in a little place	2
		Salaries up, money for curriculum and materials down	1
		Want more for doing less	3
		De-professionalizes and restricts teacher style	2
		Makes suggestions from the professional staff downplayed by administrators	2
		Strikes are no good	1
		Sometimes they get in the way	5
Secondary Teachers	18	Lower teacher stress	1
		Working conditions and preserve jobs	7
		Keep good teachers in teaching by improvements	1
		Good for teachers	2
		Gives teachers clout	3
Supervisors	25	Improves working conditions	4
		Must support good education or risk losing support	1
		Gets public to pay for education	2
		Necessary evil	3
		Should include staff development and program implementation	1
		Teachers who are young, money motivated, militant and union-oriented can destroy education	2
		Reduced quality of workmanship	2
		Blue collar mentality	2
		Reduces dedication (lack of professionalism)	8
Teacher Educators	20	Must be utilized in a positive way to reverse negative trends	2
		Good for independence	3
		Reduced dependence on administrators	2
		Teachers have more to say about what they teach	1
		Unfortunate swing from "patronizing" administrators	2
		Loss of individualism	2
		Just more militant	1
		Reduces professionalism	2
		Equal work for unequal pay	2
		Teacher Center's emphasis on "bag of tricks" destructive	1
		Undermines quality of instruction	2

N = Number of Respondents
F = Frequency of Responses

TABLE C 10.3 Tabulation of Open-Ended Responses Which Extend Position Continued-

Group	N	Summary of Responses	F
Researchers	16	For the better	2
		Improve instruction	1
		Improve working conditions (and better quality life)	2
		Lose incentives and motivation	1
		Reduce professionalism (and dedication)	3
		Changes society from one of cooperation to one of competition	1
		Create hostility in profession	4
		Restricts new ideas (and creativity)	2

N = Number of Respondents
F = Frequency of Responses

TABLE C 10.4 Tabulation of Open-Ended Responses Which Take Exception to Position

Group	N	Summary of Responses	F
Elementary Teachers	2	Depends on the school system	2
Secondary Teachers	7	Only if majority agree on what is right	1
		Not as important as other factors	2
		Must not see it as a restriction	1
		Only as it affects teaching as a whole	1
		Only because school boards do not understand teaching	1
		Only because it might reward incompetence	1
Supervisors	6	If bad teachers could be weeded out, then no effect	3
		No more for science than other areas	2
		Regional	1
Teacher Educators	8	Concerns only in some areas and not others	3
		Minor compared to the others	1
		Only a short-term perturbation	4
Researchers	1	Can not relate all trends in teaching to specific contents	1

N = Number of Respondents
F = Frequency of Responses

TABLE C 10.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	12	Not a concern for science teachers as a subject matter concern	8
		Little or no relationship (not a factor of great importance)	4
Secondary Teachers	15	Not to science teaching	3
		The dedicated teacher will do a good job despite the pressures given the support of an immediate supervisor	2
		Not a big threat or concern	10
Supervisors	11	Unionization has nothing to do with good teaching	7
		Not of major concern	4
Teacher Educators	20	Not to science teaching	8
		Not a major concern	7
		Not yet; unions are not promising what science teachers want	5
Researchers	10	Neither a cause for hope nor concern	4
		Unions should be used for professional betterment	2
		Not a big concern	4

N = Number of Respondents
F = Frequency of Responses

C 11. RATING OF MAJOR CONCERNS FOR SCIENCE EDUCATION FOR THE 80'S BY FIVE SAMPLE GROUPS

TABLE C 11.1 Result of Respondent Ratings

1 = Most important concern
5 = Least important concern

Concern	Decreased Funding	Enrollment Declines	Accountability Competency-Based	Difference in Students	Unionization
Group					
Elementary Teachers	1 (30)	3 (17)	4 (15)	2 (23)	5 (5)
Secondary Teachers	1 (49)	4 (30)	3 (32)	2 (41)	5 (11)
Supervisors	1 (63)	5 (31)	2 (37)	3 (34)	4 (33)
Teacher Educators	1 (53)	2 (52)	3 (34)	4 (20)	5 (19)
Researchers	1 (23)	2 (21)	5 (9)	4 (13)	3 (17)

Numbers in Parentheses Indicate Composite "Score" for Respondents.

C 12. MORE IMPORTANT CONCERNS IN SCIENCE EDUCATION IN THE 1980'S

C 12.1 Tabulation of Open-Ended Responses That List Important Concerns

Group	N	Summary of Responses	F
Elementary Teachers	39	Getting elementary teachers to teach science	5
		Lack of support for science in daily living	5
		Using applied science	5
		Influence of T.V. on students	4
		Support personnel	4
		New basis for school science	4
		Time for planning and doing science	3
		Science as part of total curriculum	3
		Public support for science teaching	3
		Teacher preparation in science	3
		Administrative support for science	3
		Decline in funding for science	2
		Lack of relevance of science to students	2
		Advance of pseudo-sciences	2
		Sex-role stereotyping	1
		Children with shorter attention spans	1
Secondary Teachers	63	Economic conditions	9
		Courses which exemplify science and society	7
		Too few good in-service programs	5
		Poor teacher education programs	4
		Old teachers' resistance to change	4
		Administrative attitude - lack of support	4
		Career awareness	4
		Problem with new goals (time for change)	3
		Influence of publishers	3
		Professional attitude of teachers	3
		Public apathy/mistrust	3
		More stress in school environment	3
		Teachers getting older (fewer new ones entering profession)	2
		Piagetian research ideas for secondary teachers	2
		Defining science as basic skill (reasoning skill)	2
		Use of technology in teaching	2
		Inertia and rigidity in education	2
		No view of future	1
		Emphasis on athletics	1
		Knowledge of break-throughs in science	1
		College demands	1
		Teacher "fear" of science	1
Supervisors	53	Specific societal issues	11
		In-service efforts	7
		Public apathy	6
		Economic problems	5
		Back to basics	5

N = Number of Respondents
F = Frequency of Responses

C 12. MORE IMPORTANT CONCERNS IN SCIENCE EDUCATION IN THE 1980'S

C 12.1 Tabulation of Open-Ended Responses That List Important Concerns (continued)

Group	N	Summary of Responses	F
Supervisors continued		Need for support systems	4
		Enrollment declines	4
		Poor pre-service programs	3
		Lack of leadership in science education	3
		Technology and health separate from science	3
		Separation of school leadership from teacher and public	3
		Teacher shortage	3
		Instructional management	3
		Under-represented groups in science	3
		Salaries	3
		New discoveries on learning	3
		Specific technologies in teaching	2
		Development of more human skills related to science	2
		Legislative mandates	2
		Teacher morale	1
		Teacher certification	1
		Science of implementing change	1
Teacher Educators	64	Relation of science to society	6
		Attracting poor new teachers	6
		Less financial support	5
		Teacher burn out, stagnation	4
		Scarcity of physical science teachers	4
		No science taught in elementary schools	3
		Poor pre-service program	3
		Push to make all science literate	2
		Rise of pseudo-science	2
		Use of community education	2
		Lack of leadership/direction	2
		Lack of enough in-service education	2
		Control from outside profession	2
		Lack of human enterprise in science	2
		Experience with process in lab, not life	2
		Science for under-represented	2
		Public apathy	2
		Anti-intellectualism	2
		Utility of research	2
		Young teachers leaving profession	2
		Preschool impact	1
		Real priorities in science education	1
		Emphasis upon secondary rather than elementary	1
		Private schools	1
		Look at knowledge of science by administrators and leaders	1
		Science in rural America	1
		Teachers who dislike science	1
		Force of conservatives and fundamentalists groups	1
		Multi-lingual instruction	1

N = Number of Responses
F = Frequency of Responses

C 12. MORE IMPORTANT CONCERNS IN SCIENCE EDUCATION IN THE 1980'S

C 12.1 Tabulation of Open-Ended Responses That List Important Concerns (continued)

Group	N	Summary of Responses	F
Teacher Educators continued		Little support for new curriculum models	1
		Students not futuristic	1
		Teacher salaries	1
		Lack of agreement on junior high	1
		Lack of supervisors	1
		Legislative mandates	1
Researchers	29	Societal problems	5
		National politics of economics	4
		Societal expectations regarding science	3
		Over-emphasis upon learning theory	3
		Belief in importance of traditional science	3
		Age problems for science teachers	2
		Separation of school science from real world	2
		Teacher apathy	2
		Public negative attitude toward science	2
		Separation of science and technology	2
		Teacher shortage	2
		Glorification of science/scientists	2
		Return to basics	2
		Rise of pseudo-science	2
		Worth of laboratory experience	1
		Science for under-represented	1

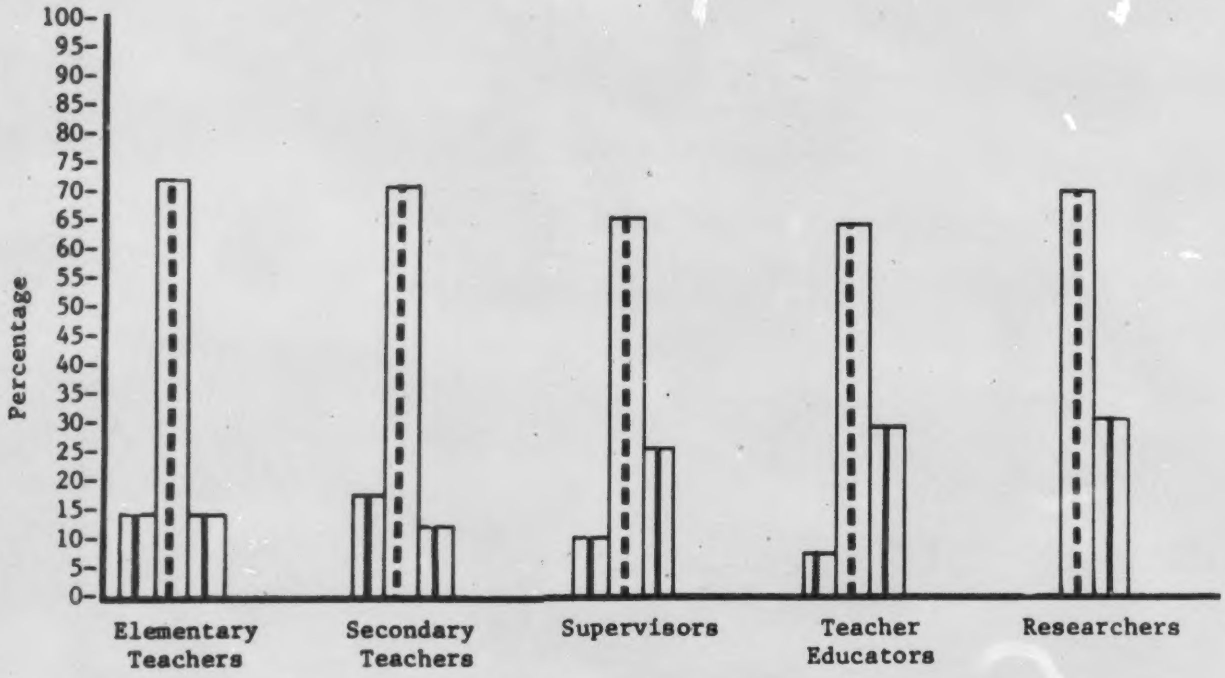
N = Number of Responses
F = Frequency of Responses

C 13. GENERAL REACTION TO "PRESENT SITUATION OF SCIENCE TEACHING"

TABLE C 13.1 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
excellent	14	17	10	7	0
satisfactory	72	71	65	64	70
disappointing	14	12	25	29	30

GRAPH C 13.1 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
(50)	(52)	(57)	(58)	(27)

TABLE C 13.2 Tabulation of Open-Ended Responses Listing the Points of Disagreement

Group	N	Summary of Responses	F
Elementary Teachers	7	Value of in-service not stressed	5
		No emphasis of administration affecting science program	4
		Some teachers poorly prepared	4
		Science is less important than other areas in elementary schools	3
		Too much emphasis on discovery	3
		No real discussion of differences between sexes	3
		No evidence reported to support ascribed blame	2
		Too philosophical - not based on facts	2
		Too many demands on teacher's time	2
		Educators follow fads too often	2
		Children more lax than formerly	2
		Less money for education	1
Secondary Teachers	6	Need better in-service	6
		Unionization emphasized too much	6
		Overestimating impact of NSF programs	6
		Need to emphasize recruiting and keeping better teachers	4
		Science and technology for survival not emphasized	4
		Stable faculties do not necessarily lead to stagnate ones	4
		Too much attention to placing blame	4
		Too many non-teaching tasks assigned to teachers	3
		Need to overhaul testing/evaluation programs	3
		Need to consider teaching technology	3
		Need more support for exemplary new materials	3
		Need more financial support	3
		Society treats schools as adversary	2
		Enrollment declines may not have to be reversed	2
		Supervisors often not helpful	2
		Many problems of last twenty years caused by teachers and professors who were draft dodgers	1
		Short laboratory periods are major problem	1
Supervisors	14	NSF curricula described as desired ends	6
		Too much focus on negative	5
		Labor organization not positive influence on science education	5
		Money and in-service not cure-alls	5
		Students have not changed as much as suggested	4
		Lacks specificity for new directions	3
		Curriculum development and reform not declining	3
		Too much focus on the past	3
		View of teaching elementary science too positive	2
		Influence of computers and new technology not discussed adequately	2
		Dogmatic explanations of science method	1

N = Number of Respondents
F = Frequency of Responses

TABLE C 13.2 Tabulation of Open-Ended Responses Listing the Points of Disagreement (continued)

Group	N	Summary of Responses	F
Teacher Educators	17	Fails to make connections to social phenomena	9
		Too narrow in scope	7
		Need more and better in-service	7
		Programs of 60's and 70's not panaceas	7
		Did not do justice to actual use of NSF programs of 60's	7
		Lacks vision	7
		No real evidence included to support views	6
		Need to encourage evaluation and assessment	6
		"Change in students" is superficial	6
		Too negative	5
		Suggestion that science education cannot affect its own destiny	4
		Too much emphasis on unionization	4
		Nation is not "anti-science"	4
		Confusion in developed, adopted, and used curricula	3
		Low turnover of teachers does not mean stagnation	3
		No attention to variation in goals	3
		No stress on safety, liability	2
		Population can never "understand" science	1
Researchers	8	Scope of concerns and potentials too limited	4
		Discussion of impact of current issues on science	4
		No stress on applying science to living	4
		Too much reliance on NSF for solutions	3
		Science basic skills skirted	2
		Consideration of impact of computers	2
		Provision for laboratory evaluation omitted	2
		Too optimistic as to actual accomplishments	2
		At times statements seem over-stated and biased	2

142

N = Number of Responses
F = Frequency of Responses

D. Analysis of Section on Recommendations for the Coming Years

Half of the *Accomplishment and Needs* working paper consists of recommendations for the future. The section begins with a discussion of the strength of diversity of thought and values, a reflection of the current crisis in science education, and a consideration of the difficulty of achieving a concise and attractive set of recommendations for the future. To be sure, the inclusion of diverse views of well over one hundred persons that are presumably reflected in the final draft of the working paper make such a clear focus upon specific actions for the future an impossible goal.

The authors suggest that there is growing recognition that the science curriculum must be more adaptable. For that reason the first major subsection under "recommendations for coming years" deals with curriculum development. Recommendations and discussion represent nearly one-half of the contents of this section. Thirteen issue statements with associated graph and table sets were used to assess this part of the section (D 1.2 through D 13.1).

A second subsection deals with the improvement of teaching. Tables and Graphs D 14.1 through D 20.1 report opinions concerning this subsection. The section ends with two very brief subsections. One deals with the encouragement of under-represented groups in the sciences; another with trends in federal support for science education. Tables and Graphs D 21.1 through D 24.1 assess impressions of these recommendations. The assessment ends with two general statements - one a summary statement concerning the working paper as a whole and one asking for general reactions and indications of disagreements with points made in the Recommendations section of the paper. (Tables and Graphs D 25.1 through D 26.2).

Some of the positions sampled to assess the impression of the five leadership groups regarding recommendations in the working paper in the area of curriculum development may have been arbitrary. However, the inclusion of thirteen areas for study do provide a sufficient number to discover general agreements and disagreements as well as new insights into recommended actions and directions at the end of 1980.

Table and Graph D 1.1 indicate the results of the ratings for the idea that lack of suitable materials for science instruction in the elementary school is a severe problem. An added idea (from the working paper and the questionnaire) defined "suitable" to include those materials which would facilitate coordination of science with reading, language arts, and other areas in the elementary school. It is apparent that there is general agreement among both teacher groups and the supervisor group. Teacher educators (75 percent) and researchers (62 percent) also agree but not to the extent that the other groups do.

Table and Graph D 1.2 provide a picture of the categorization of the open comments regarding the recommendation that more suitable materials be made available for the teaching of elementary science - that indeed shortages do exist and represent serious problems. Tables D 1.3, D 1.4, and D 1.5 provide tabulations of the comments which 1) expand the idea, 2) generally agree while taking exceptions (some of these persons marking the checklist "neutral"), 3) reflect disagreement with the statement.

Table and Graph D 2.1 deal with the recommendation that junior high school science programs should provide greater diversity in method and content to reflect the great diversity among learners at this level. The ratings are all positive with the most agreement given by elementary teachers (79 percent), teacher educators (78 percent), and researchers (75 percent). The fact that twenty-six percent of the secondary teachers sampled disagreed with this recommendation is of special interest.

Table and Graph D 2.2 indicate the results of categorizing the open comments provided by respondents. Table D 2.3 is a tabulation of positive comments provided by each respondent group which tended to enlarge upon the basic idea. Table D 2.4 includes a similar tabulation of the open comments which tended to agree with the recommendation that greater diversity in content and method be sought for the junior high school while taking some exception. Table D 2.5 is a summary of relatively few open comments which disagreed with this recommendation.

Tables and Graphs D 3.1 and D 4.1 are concerned with the idea that laboratory instruction needs to be strengthened because it motivates students and it tends to improve student attitudes toward science. It can be seen in Table and Graph D 3.1 that there is agreement that problem oriented laboratories tend to motivate students. However, fewer than half of the teacher educators agree and almost one-fourth of the secondary and the teacher educators disagree. The idea that laboratories tend to improve student attitudes toward science produced much more agreement, especially among the teacher groups and the supervisors. Researchers rated the ability of the laboratory to improve student attitude toward science lower than did the other groups.

Tables and Graphs D 3.2 and D 4.2 provide an analysis of the open comments concerning these two functions of the laboratory in science classrooms. Tables D 3.3, D 3.4, and

D 3.5 include summaries of the open comments which expand the idea; take exception to some aspects of the statement while contending basic agreement, and those that disagree. Similar information is provided in Tables D 4.3, D 4.4, and D 4.5 regarding the laboratory and its effect in improving student attitudes toward science.

Table and Graph D 5.1 provide opinions regarding the recommendation that traditional offerings in science should be expanded and organized in ways other than by discipline. There is general agreement concerning the value of this recommendation. Of special interests (and concern) is the twenty-six percent of the secondary teacher group who disagree with such a recommendation.

Table and Graph D 5.2 provide tabulations of the open comments concerning this recommendation. The open comments which expand the idea are included as Table D 5.4. The comments which disagree with the recommendation are included as Table D 5.5.

Table and Graph D 6.1 provide information regarding the ratings on the recommendation (and/or claim) that community college science is (should be) more flexible and varied than that in K-12 programs. There is general agreement indicated among the groups with strongest support coming from the elementary teacher group. Half of the respondents in the other four groups tend to agree; one-fourth disagree.

Table and Graph D 6.2 provide information concerning a general categorization of the open comments for this recommendation. Table D 6.3 is a tabulation of comments which expand on the notion; Table D 6.4 is a tabulation of comments which take some exception while basically agreeing; Table D 6.5 is a tabulation of comments which are negativ regarding the position that science is more flexible and varied in community colleges.

Although laboratories as a feature of some undergraduate science courses have been abandoned on many campuses, the authors of the working paper took a stand on the importance of laboratory experience for students enrolled in science in colleges. Table and Graph D 7.1 provide information regarding the views of the five sample groups used in this assessment regarding this recommendation. There seems to be strong agreement regarding the importance of laboratories in college science instruction - except for the researchers where agreement is stated only by sixty-five percent of the group.

Table and Graph D 7.2 provide a summary of the "agree" comments provided by the five sample groups concerning the recommendation that college laboratories not be abandoned. Respondents were asked to comment specifically upon the current trend for fewer laboratories in introductory college courses. Table D 7.3 is a summary of the comments which tended to expand the idea (not merely re-state the recommendation, which was a fairly common occurrence). Table D 7.4 is a summary of the comments which include one or more exceptions to a position of general agreement concerning the recommendation. Table D 7.5 is a summary of the comments which tend to disagree with the direction suggested in the recommendation for future action regarding the return to laboratories as important and vital parts to all college science courses.

The next three items in the questionnaire were all concerned with the area of teacher education curricula. One of the recommendations in the working paper is that preservice programs for the preparation of elementary teachers should include formal study in the biological, physical, and earth science areas. Table and Graph D 8.1 provide information regarding the relative agreement and disagreement among the five groups used in this study. Teachers and supervisors agree rather strongly (77 to 85 percent agreeing). However, just over half of the teacher educators and researchers agree. One-third of these two groups disagrees with the recommendation.

Table and Graph D 8.2 provide a summary and categorization of the open-ended comments. Table D 8.3 is a tabulation of the ideas which expand on the recommendation that elementary education majors have experience in each discipline of science. Table D 8.4 is a tabulation of comments from respondents which tend to agree with some exception or modification. Table D 8.5 is a tabulation of responses from each group which disagreed with this recommendation.

A second position from the working paper regarding teacher education curricula was also included in this study. One item in the questionnaire stated that the correction of inadequate science preparation for teacher education students should be a major priority of the 80's. Table and Graph D 9.1 are indications of the pattern of agreement and disagreement among the five sample groups. As might have been expected, there was greatest agreement for this need among elementary teachers (85 percent). Significant agreement for this position was indicated for secondary teachers as well (73 percent), supervisors (67 percent), and teacher educators (53 percent). Interestingly, researchers were almost evenly divided between those who agreed and those who disagreed. A third of the teacher educators and nearly half of the researchers seemed to feel (by disagreeing with the position) that preservice teachers are currently receiving adequate preparation in the discipline of science. Or, they may be saying that the science they typically receive in college is poorly taught and provides a poor model for K-12 science teaching.

Table and Graph D 9.2 provide a summary of the open comments regarding the issue of whether or not the lack of preparation in science is a major problem for teacher education curricula. The comments reflect the views of each group in the general rating. Researchers and teacher educators (college instructors) tend to be far more negative about extensive preparation in traditional college science as an important need for the 80's.

Table D 9.3 provides a tabulation of the "agree" responses which tend to expand on the idea for each group. Table D 9.4 is a similar summary of the statements which tend to offer exceptions or qualifications to basic agreement that more science preparation is a recommendation for the future for solving some of the problems in science education. Table D 9.5 is a tabulation of the comments of respondents who disagree that increasing science requirements in teacher education programs is an important recommendation for the future--at least science as it is commonly offered and taught in colleges.

Respondents were also asked to list other major problems with teacher education programs which need attention in the future. Table D 10.1 is a tabulation of the suggestions of each of the sample groups. Although respondents were asked to indicate problem areas considered more serious than the content preparation for teachers, few did so. Items most frequently checked were those associated with science as viewed in dimensions other than content and process. Problem areas mentioned as "move important" than content preparation per se for prospective teachers were the following: experience with the science-society interface, practice with using science, decision-making in science, improving college science programs, increasing the cooperation between school and college in preparing teachers, daily skills required of effective teachers.

Another major recommendation in the working paper was concerned with a renewed effort with teaching science as inquiry in K-12 classrooms. Table and Graph D 11.1 indicate the views of the respondents in all five groups concerning this need for the future. Secondary teachers, elementary teachers, and supervisors tend to agree strongly with the recommendation. There is also general agreement among teacher educators (75 percent agreement) and researchers (57 percent agreeing). However, there is also disagreement among members of three groups about the desirability of continuing with inquiry as a major goal. Nearly a third of the researchers disagree that teaching science as inquiry should be a goal of teaching for the 80's. Although there continues to be strong agreement concerning the desirability of inquiry teaching, the lesser agreement and the disagreement by such a significant number of the research community may be an indication of a major transition in philosophy of science teaching for the 80's.

Table and Graph D 11.2 provide a view of the open comments regarding the importance of inquiry as a continuing major goal. Table D 11.3 is a tabulation of the comments which tend to agree while expanding upon that idea. Table D 11.4 provides a tabulation of the positive comments which tend to offer one or more exceptions or qualifications to basic agreement. Table D 11.5 provides a tabulation of the comments which disagree. The view that teaching science as inquiry may be inappropriate lends weight to the view that major changes are occurring with respect to this goal of science teaching.

Another recommendation advanced in the working paper was the need for greater effort with improving the strategies teachers use in the classroom. Table and Graph D 12.1 provide the results of the investigation concerning the level of agreement for this idea among the sample groups. It is apparent that there is general agreement among all groups that attention to teacher classroom practices is a major concern for science teaching for the future. It is interesting to note that 10 percent was the highest number disagreeing with this need for any of the groups.

Table and Graph D 12.2 provide a view of the categorization of the open comments concerning the recommendation that major effort be exerted for improving classroom practices. Table D 12.3 provides a tabulation of the positive comments which tend to expand or amplify the idea for all groups. Table D 12.4 is a similar tabulation of the open comments which take some exception to the position while basically agreeing. Table D 12.5 is a tabulation of the comments which show disagreement that concern for teaching strategies should not be a major thrust in science education for the 80's.

The last statement used from the working paper with the respondent groups for the general recommendations in the area of curriculum development was concerned with attention to budgets, including those for instructional equipment and supplies. The results of the rating scale for the groups are presented as Table and Graph D 13.1. It is readily apparent that there is strong agreement concerning this recommendation (90 percent for secondary teachers and 93 percent for supervisors). Researchers are not as convinced that this is a major problem (and thereby a primary recommendation for future action).

Table and Graph D 13.2 are indications of the variety of open responses provided for this item. Several ideas for attending to equipment and supply problems were proposed by persons in each group. Table D 13.3 is a tabulation of the results for those who chose to extend the position. Table D 13.4 is a tabulation of the exceptions taken by persons to the basic idea. Table D 13.4 is a tabulation of responses which disagree with the position that budget problems for science teaching should receive immediate attention. Many of these ideas suggest the inappropriate, and/or lack of, use for many materials already in schools. Some point to more urgent problems.

The second major part of the section of the working paper dealing with the recommendations for the coming years was concerned with the improvement of teaching. This section of the paper was divided into five parts; namely, recommendations dealing with inservice education, preservice education, competency-based teacher education, community involvement, and research in science education. Seven items in the study instrument were structured to assess the appropriateness and degree of agreement among the five groups of leaders in science education concerning these five areas.

Two position statements were used to study the several recommendations in the area of inservice education. The first of these was that renewed attention to inservice teacher education. The first of these was that renewed attention to inservice teacher education should be a major priority; the second suggested that there should be renewed support for science consultants/coordinators. Table sets D 14 and D 15 provide the results of the assessment regarding these two recommendations for the coming years.

It can be seen in Table and Graph D 14.1 that there is widespread support for the general importance and the need for further efforts in the area of inservice teacher education. Well over 90 percent of respondents in all five groups agreed.

There is generally strong agreement with the desirability of more consultant help as noted in Table and Graph D 15.1. As could be expected, the degree of agreement among supervisors is higher than for any of the groups. The secondary teacher group provides the least support for the recommendation that increased support be sought for consultant assistance.

Tables and Graphs D 14.2 and D 15.2 provide information concerning the recommendation that more support is needed for inservice education in general and for increased consultant help in particular. Tables D 14.3 and D 15.3 are tabulations of the comments which tend to extend the recommendations. Similarly, Tables D 14.4 and D 15.4 are tabulations of the exceptions to the two recommended actions. Tables D 14.5 and D 15.5 are tabulations of the "disagree" comments.

It is interesting to note the different perceptions among the professional groups regarding administrators, supervisors, and leadership personnel, and methods for dealing with professionals at all levels. Some of the problems with respect to supervision and supervisors are apparent when Tables D 15.4 and D 15.5 are reviewed.

The greater involvment of schools and teachers in the preservice education of teachers was the basis of another recommendation. Table and Graph D 16.1 provide information regarding the degree of agreement among the five groups. The agreement is high for all groups; it is highest among elementary teachers (94 percent and lowest among secondary teachers 79 percent).

Table and Graph D 16.2 provide information regarding the open comments. The very positive reaction concerning the recommendation is evident among all the groups. Table D 16.3 is a tabulation of the positive responses which tend to add a dimension to the recommendation. Table D 16.4 is a tabulation of the responses which provide one or more exceptions to general agreement. Table D 16.5 is a tabulation of the relatively few comments displaying disagreement for the recommendation.

As previously mentioned, the issue of competency-based teacher education was one of the five topics included in the subsection concerned with recommendations for the future in the area of improvement of teaching. The authors of the working paper discussed the competency-based phenomenon, the issues presented by proponents as well as problems that have been elaborated. The paper ended with a "non-recommendation" and the observation that more study was needed. In order to assess the professional views of competency-based teacher education programs, a recommendation was included which simply stated that competency-based teacher education programs should be encouraged.

Table and Graph D 17.1 provide the results of this recommendation. The two teacher groups support this idea. Fewer than half of the supervisors, teacher educators, and research groups support it. In fact, significantly more teacher educators and researchers disagreed than agreed. This represents differences between practitioner groups and college staff members, with supervisors appearing to be the compromise group.

Table and Graph D 17.2 report the results of categorizing the open comments regarding the desirability of competency-based teacher education. Table D 17.3 is a tabulation of the comments which agree and add an idea: Table D 17.4 is a listing of the comments which agree while taking one or more exceptions to the comment; Table D 17.5 is a tabulation of the comments which disagree to the "proposed" recommendation.

tabulation of the comments which disagree to the "proposed" recommendation.

Another of the five major points in this subsection was concerned with community involvement in the improvement of teaching. That greater involvement in science curricula, teaching, and student experiences should be encouraged was advanced by the authors of the working paper. Table and Graph D 18.1 is the result of the relative ratings of this recommendation among the five respondent groups. There is general agreement, with elementary teachers the most positive (85 percent agreeing) and secondary teachers the least positive (66 percent agreeing).

Table and Graph D 18.2 provide the results of the categorization of the open comments regarding the recommendation. Table D 18.3 is a tabulation of the comments which agree and expand the position. Table D 18.4 is a tabulation of open comments which take exception with some aspect of the position while basically agreeing. Table D 18.5 is a tabulation of the comments which disagree. It is interesting to note that some persons in each group are anxious to keep non-professionals out of the schools and students away from first-hand experiences in communities - at least those that involve community persons.

The last major division of the subsection dealing with the improvement of teaching is concerned with research in science education. Tables and Graphs D 19.1 and D 20.1 are concerned with two facets of this issue. The first recommendation is that additional research in science education should be encouraged and supported; the second suggests that greater cooperation between practitioners and researchers should be encouraged. In both cases the recommendations are supported by all responding groups. The greater support among researchers, than among other groups, for the encouragement of more research is not unexpected.

Tables and Graphs D 19.2 and D 20.2 are the results of tabulation of the respective sets of open comments for the two recommendations. Tables D 19.3 and D 20.3 are tabulations of the open comments which agree while extending the position. Tables D 19.4 and D 20.4 are tabulations of the comments which take exception to the recommendations while basically agreeing. Tables D 19.5 and D 20.5 are tabulations of the comments which disagree with the recommendations for future action.

The third major category in the recommendations section (after curriculum development and the improvement of teaching) was concerned with the encouragement of women and minority students in the sciences. A single recommendation was used to assess professional views in this area. Table and Graph D 21.1 provide the results of the rating. There is general agreement among all groups that this is an important recommendation. The agreement is highest among researchers (77 percent) and lowest among secondary teachers and supervisors (each with 58 percent agreeing).

Table and Graph D 21.2 provide information regarding the categorization of the open comments regarding the recommendation that efforts to gain greater participation of women and minorities be increased. Table D 21.3 is a tabulation of the open comments which tend to add insights to the recommendation while agreeing with it. Table D 21.4 is a tabulation of agree responses which tend to take exception to some aspect while agreeing in general. Table D 21.5 is a tabulation of those comments which tend to disagree. The respondents who disagree tend to charge that major interest in these problems is caused by the availability of federal dollars. Some suggest that the problems have been addressed adequately. Several suggest that the recommendation simply does not address a problem of high priority in science education.

That fourth and final subsection of the recommendations section of the working paper deals with the trends in federal support for education and their implications for science education. One recommendation was concerned with the desirability of increased NSF support for curriculum dissemination and implementation activities. Table and Graph D 22.1 provide the results from the five sample groups concerning their level of agreement with the recommendation. Generally, the agreement is high, especially among supervisors where the level of agreement is above 90 percent. The exception is found among researchers where the level of agreement is below 50 percent.

Table and Graph D 22.2 provide the results of a categorization of the open comments regarding this issue. Table D 22.3 is a tabulation of the open comments which add a dimension to the recommendations; Table D 22.4, a tabulation of comments which agree while taking one or more exceptions to the recommendation. The sizable disagreement among researchers centers upon the issue of the involvement of the federal government in such activities and the lack of evidence of the effectiveness of such programs during the 1960's.

Table and Graph D 23.1 provide results of a similar recommendation. In this instance, however, it is recommended that greater NSF support be given to in-service teacher education. All groups except for the teacher educators rate this recommendation more favorably than the preceding one concerned with support for curriculum dissemination and implementation activities. The researchers continue with the lowest level of agreement (72 percent agreeing) even though the agreement if much greater than it was in the preceding situation.

Table and Graph D 23.2 provide information concerning the categorization of the open comments concerning this recommendation. As before the results parallel those given in the general ratings. Table D 23.3 is a tabulation of the open comments which add to the basic idea. Table D 23.4 is a tabulation of the comments which take some exceptions to the recommendation while basically agreeing. Table D 23.5 is a tabuluation of the comments which disagree. In general, the disagreement parallels very closely those disagreements regarding benefits derived from NSF involvement that were reflected in the preceding discussion (Table D 22).

The section of the working paper ended with a general recommendation that financial support for science education should be significantly increased for the next decade. The five respondent groups were asked to rate this recommendation. Table and Graph D 24.1 provide the results. The level of agreement is high with teacher educators and researchers showing less agreement (71 percent and 72 percent respectively) and higher levels of disagreement than is the case for the other three groups.

Table and Graph D 24.2 provide the results of categorizing the open comments. In general, the results reflect the general rating on the checklist. Table D 24.3 is a tabulation of the open comments which add information while agreeing. Table 24.4 is a tabulation of responses which offer an exception to the recommendation while basically agreeing. Table D 24.5 is a tabulation of the comments which disagree. The disagreements center upon the appropriateness of federal involvement in education, the real results of federal support during the past two decades, and whether or not real needs exist.

The section of the paper concerning recommendations for the coming years ends where it began. The authors suggest that professional science educators should constantly assess needs, define new problems, and establish new goals. Respondents were asked to react to this pervading philosophy of the paper. Table and Graph D 25.1 provide the results of such a general rating. Clearly there is great agreement concerning this view and this general recommendation.

Table and Graph D 25.2 provide information concerning the nature of the open comments provided regarding this point of general philosophy. Table D 25.3 is once again the tabulation of open comments which expand this idea; Table D 25.4 a tabulation of comments which take exception while agreeing in general; and Table D 25.5 a tabulation of the comments which disagree.

As in the case of the analysis of the three preceding sections of the paper, respondents were asked for their general comments concerning the section dealing with recommendations for the coming years. These comments for each respondent group were classified and reported as Table D 26.1. It can be seen that this section of the paper was not perceived as a strong one. More researchers and elementary teachers than respondents in other groups felt the treatment was excellent. However, more elementary teachers found it disappointing than those who found it excellent or satisfactory. The majority of secondary teachers found the section satisfactory but a significant number found it disappointing. The situation for supervisors was close to that reported by secondary teachers. Although more teacher educators responded than did researchers, the proportions are very similar. Respondents are nearly equally divided between those who regard the section satisfactory and those who found it disappointing. In both instances, the number who found the section excellent was also half the number in the group who found it either satisfactory or disappointing.

Respondents were again asked to list specific areas where they disagreed with positions taken by the authors of the paper. Table D 26.2 is a tabulation of these areas of disagreement for elementary teachers, secondary teachers, supervisors, teacher educators, and researchers respectively. The comments are included in the tables with little categorization in order to preserve more closely the specific disagreement of members of the leadership in science education in the five groups. The lists in these five tables resulted in greater condensation than with previous sections because of the greater specificity of the twenty-four recommendations selected by the research team to assess the validity of this large section of the paper. In some cases some respondents referred to other recommendations for which there was greater agreement and/or identity than for the twenty-four recommendations included.

D 1. ATTENTION SHOULD BE DIRECTED TO A SHORTAGE OF SUITABLE* MATERIALS FOR SCIENCE INSTRUCTION IN THE ELEMENTARY SCHOOL

(*Suitable includes material which combine science with reading, mathematics, and other areas of the program.)

TABLE D 1.1 Result of Respondent Ratings

		Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
Percentage	agree	92	88	86	75	62
	disagree	4	2	3	13	8
	neutral	4	10	11	12	30

GRAPH D 1.1 Graphic Presentation of Respondent Ratings

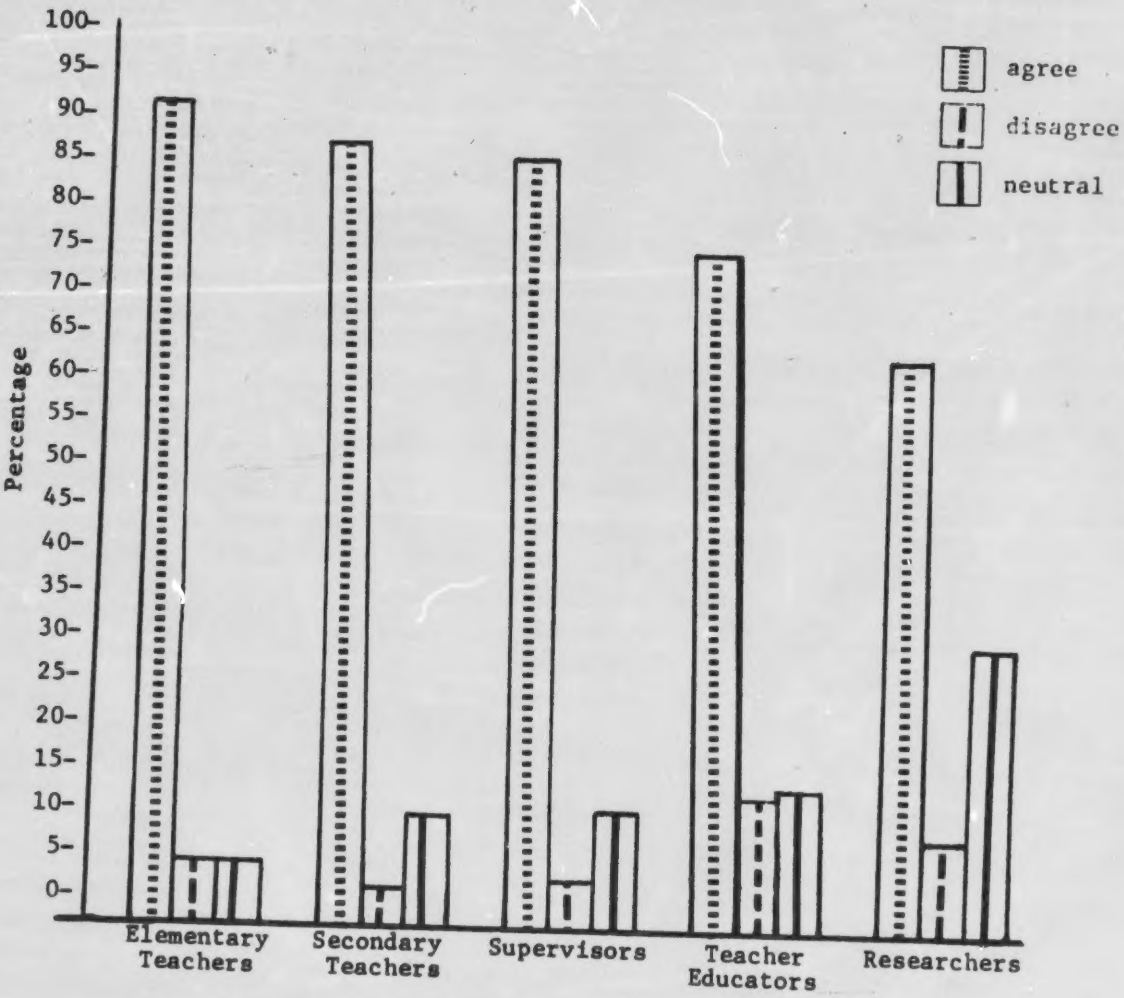
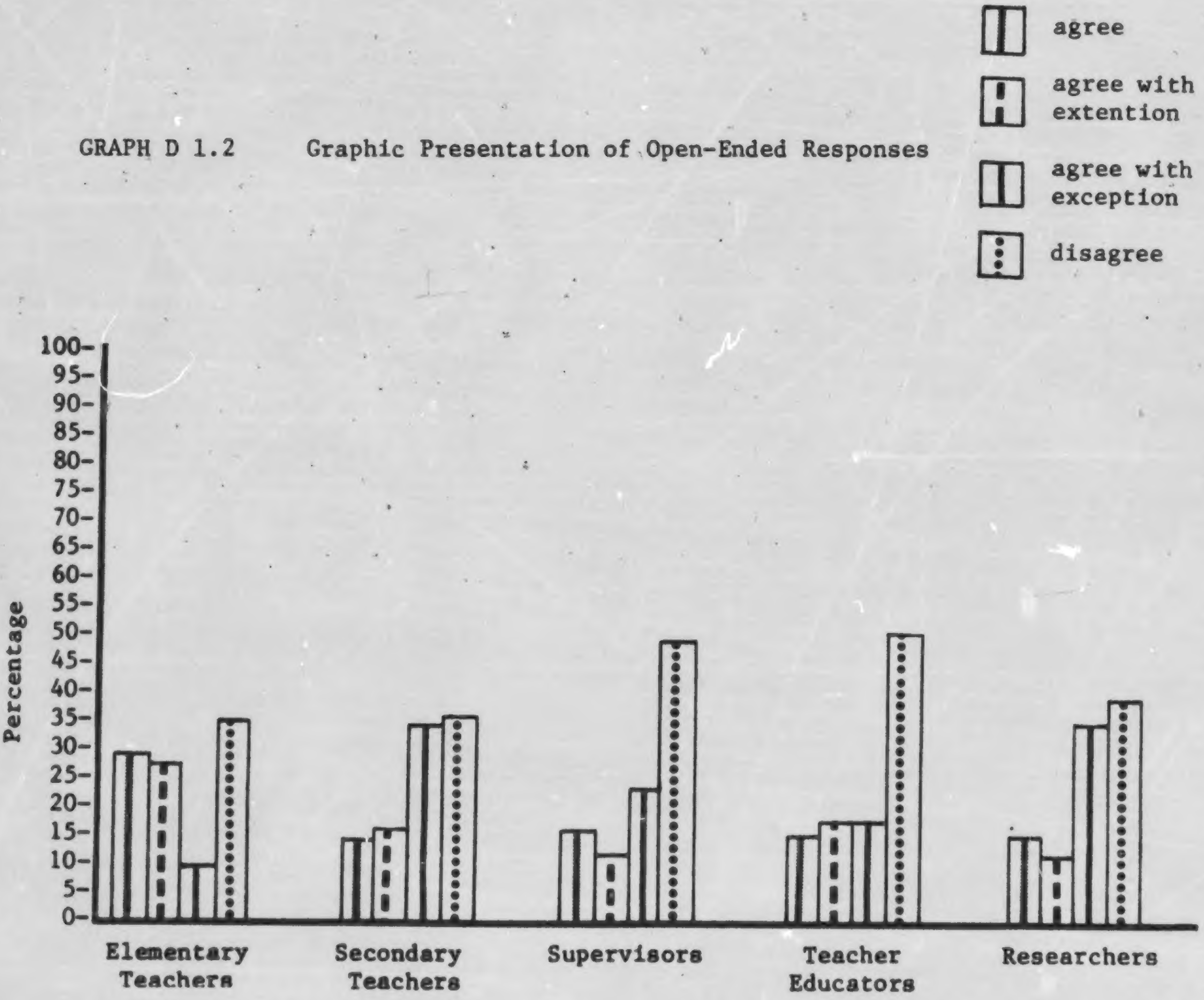


TABLE D 1.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	29	14	16	15	15
agree with extention	27	16	12	17	12
agree with exception	9	34	23	17	34
disagree	35	36	49	51	39

GRAPH D 1.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(34) (58) (51) (59) (41)

TABLE D 1.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	9	Emphasis on problem solving, provide experiences	3
		More inservice	4
		More money for programs	2
Secondary Teachers	9	Expose students to science early; teach reading skills	3
		Train teachers to like science - too many are intimidated by science	2
		Expect too much of one teacher to teach all subjects well	2
		Need more stimulating programs to demonstrate real science	2
Supervisors	6	Basic readers can contain more non-fiction	2
		Include process as well as content	2
		Reading readiness	1
		Train teachers to use materials	1
Teacher Educators	10	Need to build confidence and skills of teachers to use strategies and materials for positive attitude toward science teaching	3
		Integrate science as a language art; help develop reading readiness	1
		Teachers do not have time to develop curriculum; instead they rely on profit-making publishers	2
		Need support materials	4
Researchers	5	May be the only way science will survive on elementary level	3
		More teacher training	2

N = Number of Respondents
F = Frequency of Responses

TABLE D 1.4 Tabulation of Open-Ended Responses Which Take Exception to Position

Group	N	Summary of Responses	F
Elementary Teachers	3	Budget is the problem	2
		Need more supplementary material	1
Secondary Teachers	20	There is suitable material, but shortage of money to buy programs	4
		Even with materials, teachers resent being told what to do	2
		Uneven science exposure is a problem	4
		Many low cost materials	2
		Poor direction by supervisors, poor training in utilizing programs	5
		Teachers need flexibility, creativity	3
Supervisors	12	Science programs that combine math skills and reading skills may lose science concepts in the shuffle	3
		Need to learn how to use existing programs	4
		Need more financial support to purchase programs	5
Teacher Educators	10	Problem is teachers were not using them	3
		Teachers' attitudes a problem	3
		Don't want to lose science content and process through combining	4
Researchers	14	Materials available, need to make sure they teach, not entertain	5
		Don't leave out science when combined with other things	3
		Geared to different ability levels	4
		Get materials available into schools; need more money	2

N = Number of Respondents
F = Frequency of Responses

TABLE D 1.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	12	Teacher training inadequate; should be able to teach without special materials	4
		Low cost materials available	3
		Need more planning time; day is too short	3
		Need more money	2
Secondary Teachers	21	Shortage of teachers, inability of teachers; lack of teacher training and good science attitudes	8
		Higher priority set by schools	6
		Get teachers to teach programs, not make excuses	7
Supervisors	25	More materials than teachers can use; need help organizing them	7
		Teachers do not know how to use them; they are unprepared and uninterested	7
		Need to retain staff in use of programs	4
		More important is lack of elementary science emphasis	7
Teacher Educators	30	Lack of ability to use materials, no skill or belief in what they teach	6
		Teacher is key; need more inservice to raise teacher literacy and to encourage use	5
		Skill in integrating subjects is lacking	4
		Materials available; no one knows how to use them	13
Researchers	16	Materials available, but costly programs simply not being used	5
		Teacher is the key	7
		Adequate at elementary level, but need more for high school	4

N = Number of Respondents
F = Frequency of Responses

D 2. GREAT DIVERSITY IN CONTENT AND APPROACH SHOULD BE ENCOURAGED IN THE JUNIOR HIGH SCHOOL

TABLE D 2.1 Results of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	78	59	60	79	75
disagree	9	26	16	12	11
neutral	13	15	24	9	14

GRAPH D 2.1 Graphic Presentation of Respondent Ratings

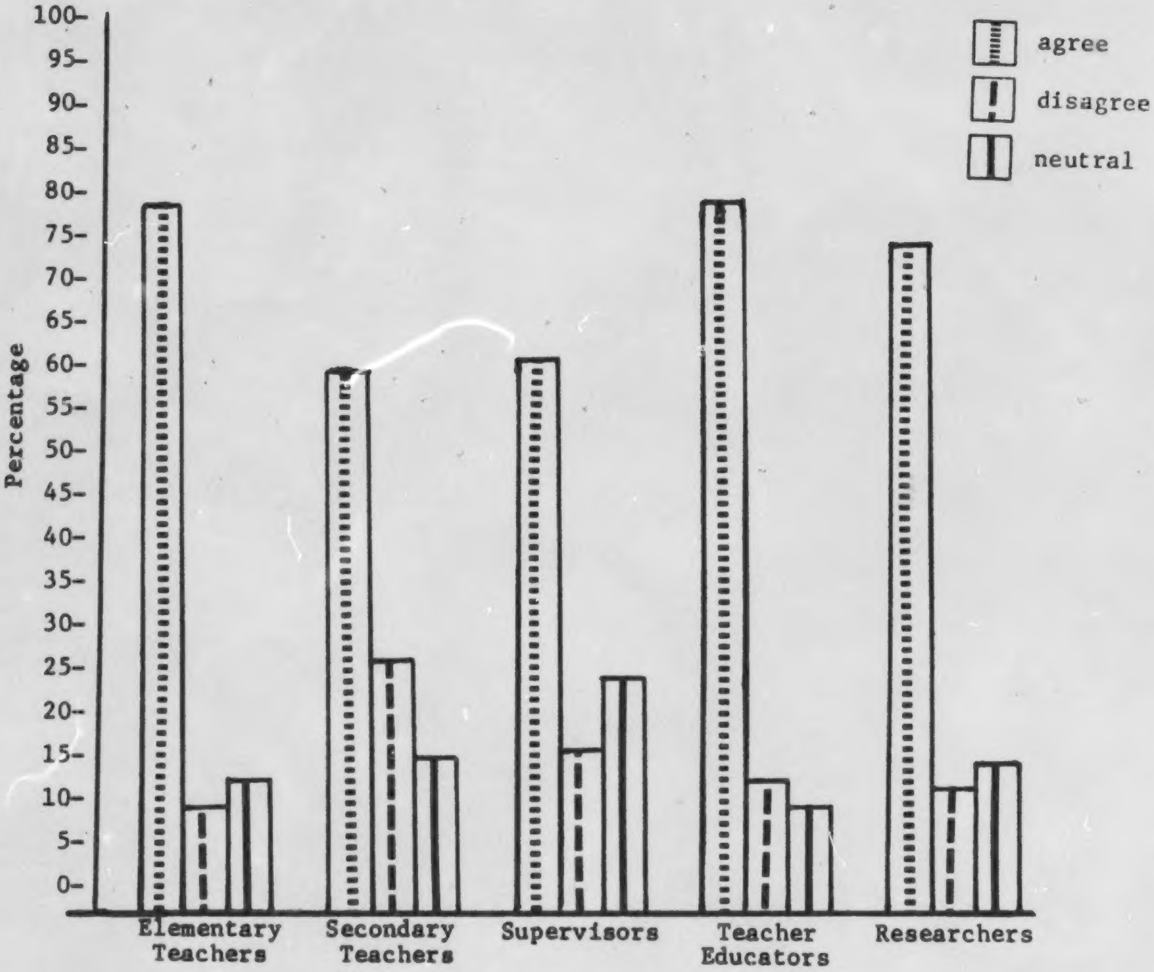
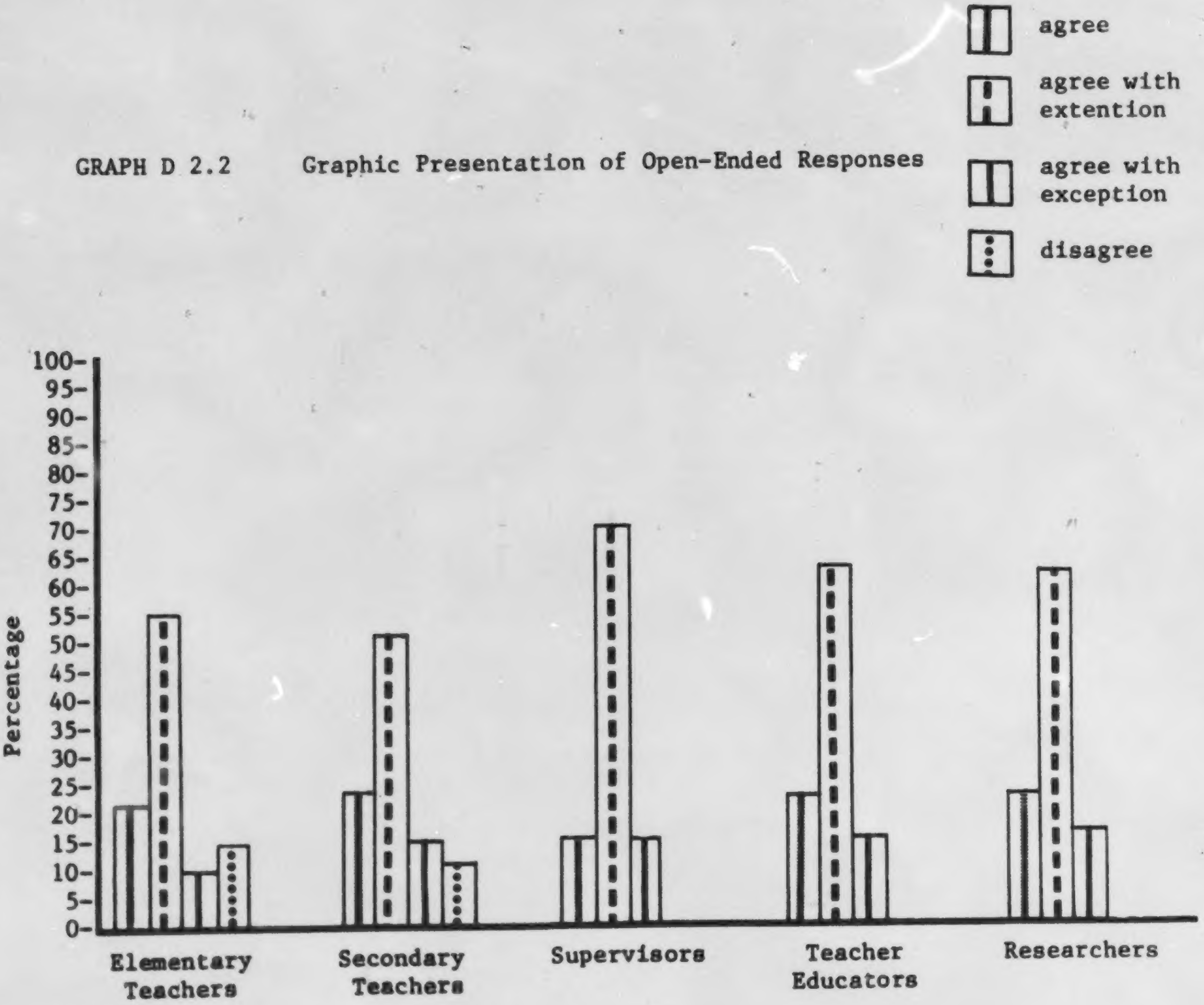


TABLE D 2.2 Categorization of Open-Ended Responses

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	21	23	15	22	22
agree with extention	55	51	70	63	62
agree with exception	10	15	15	15	16
disagree	14	11	0	0	0

GRAPH D 2.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
(29)	(53)	(41)	(41)	(37)

TABLE D 2.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	16	Students curious at this age, so opportunity for diversity; gives them choices; need something really motivating	4
		Pare down content; concern for physical/social development takes priority; learn to enjoy science and build up depth gradually	5
		Need small groupings to overcome problems with discovery learning	3
		Need good standard curriculum at all levels, even elementary	4
Secondary Teachers	27	All levels K-12 should take this into account	4
		Small groups are needed; emphasis on science processes	5
		Less emphasis on discovery beyond their ability	4
		No overlap or repeats of experiences; not reduce science courses	2
		Flexible programs more responsive to adolescent needs and the abilities of individual students	3
		More relevant materials	4
		NSF has long neglected junior high	3
		Activity-centered approach	2
Supervisors	29	Needed for all levels	4
		Need science curriculum in junior high, not watered-down high school science	6
		Make sure basic research and lab skills are achieved; leave content open	5
		Less life science, more physical and earth science	3
		Too much diversity in teacher competency, interest, and preference; need more training	6
		Structured diversity; use science to teach skills, improve literacy; give them choices	5
Teacher Educators	26	Just beginning to appreciate need	2
		Coordinate programs K-12; small class size to individualize; flexibility is key	5
		Teachers must be effective with diverse group; must educate, not entertain, them	3
		Middle school more effective; important on all levels	5
		Need more materials	3
		Content is there, top notch teachers aren't	5
		Diversity of teaching methods, not content; avoid orienting for high school	3
Researchers	23	Organized diversity, student exploration; study physical science	8
		Teacher is key; curricula won't work by themselves	7
		Many are not used appropriately	4
		Needed at other grades too	4

N = Number of Respondents
F = Frequency of Responses

162

TABLE D 2.4 Tabulation of Open-Ended Responses Which Take Exception to Position

Group	N	Summary of Responses	F
Elementary Teachers	3	Kids may not be formal	1
		Many teachers teaching out of field	1
		Building strawmen; the kids are on to us	1
Secondary Teachers	8	But what about the big ideas	2
		Avoid hodgepodge of materials	3
		Do not forget individual student's needs	2
		Hands on, demonstrations, exploration	1
Supervisors	6	Content diversity not as necessary as instructional diversity	2
		Diversity to give general understanding of science	2
		Do notoverlook middle school movement	2
Teacher Educators	6	Diversity can weaken things; can adapt materials; diverse materials would not be used	2
		Content and impact where science meets society	2
		Teachers not prepared to deal with adolescents	1
		Taught in ways appropriate to junior high	1
Researchers	6	Laboratories appropriate for some; for others lecture is better	3 3
		Maybe the last formal good science class they take	

N = Number of Respondents
F = Frequency of Responses

TABLE D 2.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	4	Greater diversity found in senior high	3
		Students not ready for unified science	1
Secondary Teachers	6	This type of teaching does not prepare students for organized high school structure	3
		Too much diversity can have undesirable results	2
		Choosing courses at this age weakens interests	1
Supervisors	0		
Teacher Educators	0		
Researchers	0		

N = Number of Respondents
F = Frequency of Responses

D 3. LABORATORY INSTRUCTION SHOULD BE ENCOURAGED TO A GREATER DEGREE

TABLE D 3.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	62	54	53	46	51
disagree	6	22	15	25	22
neutral	32	24	32	29	27

GRAPH D 3.1 Graphic Presentation of Respondent Ratings

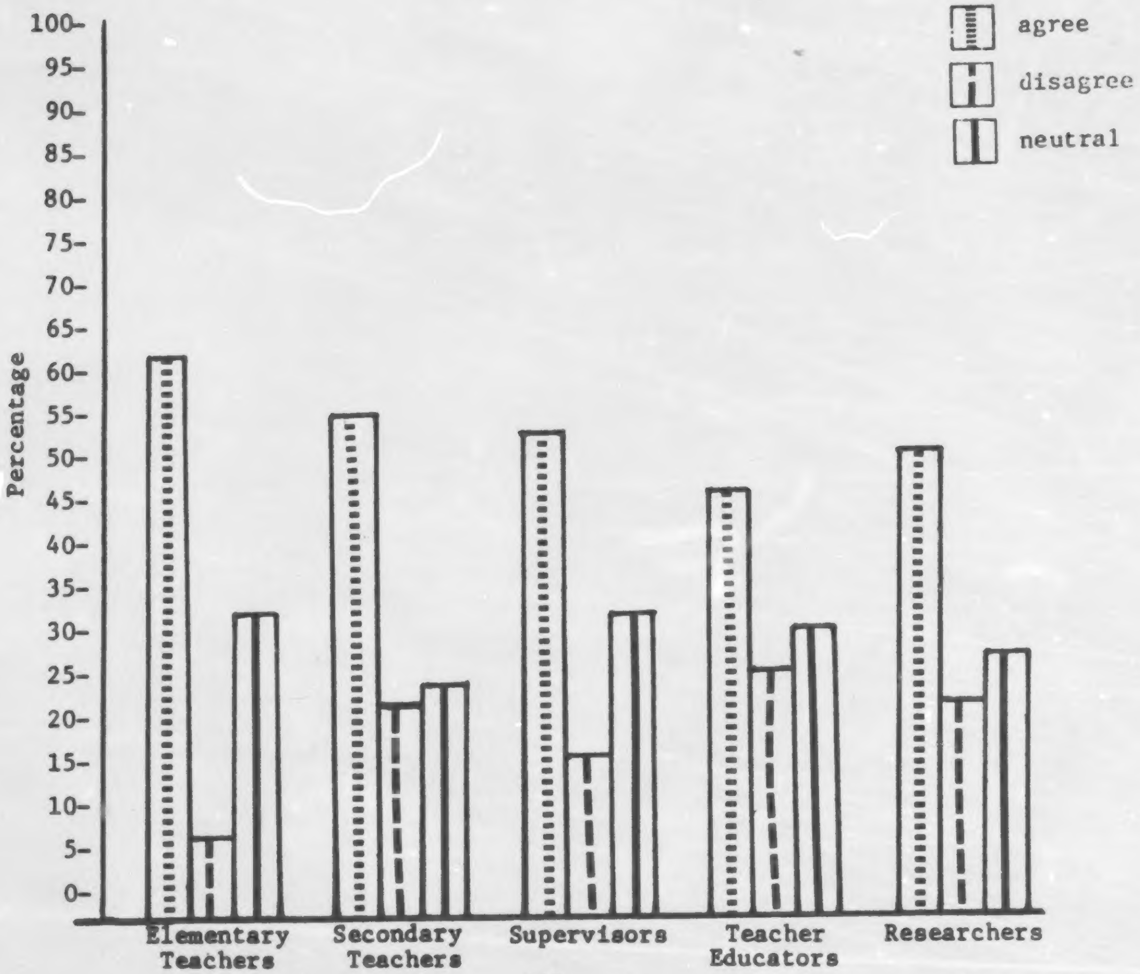
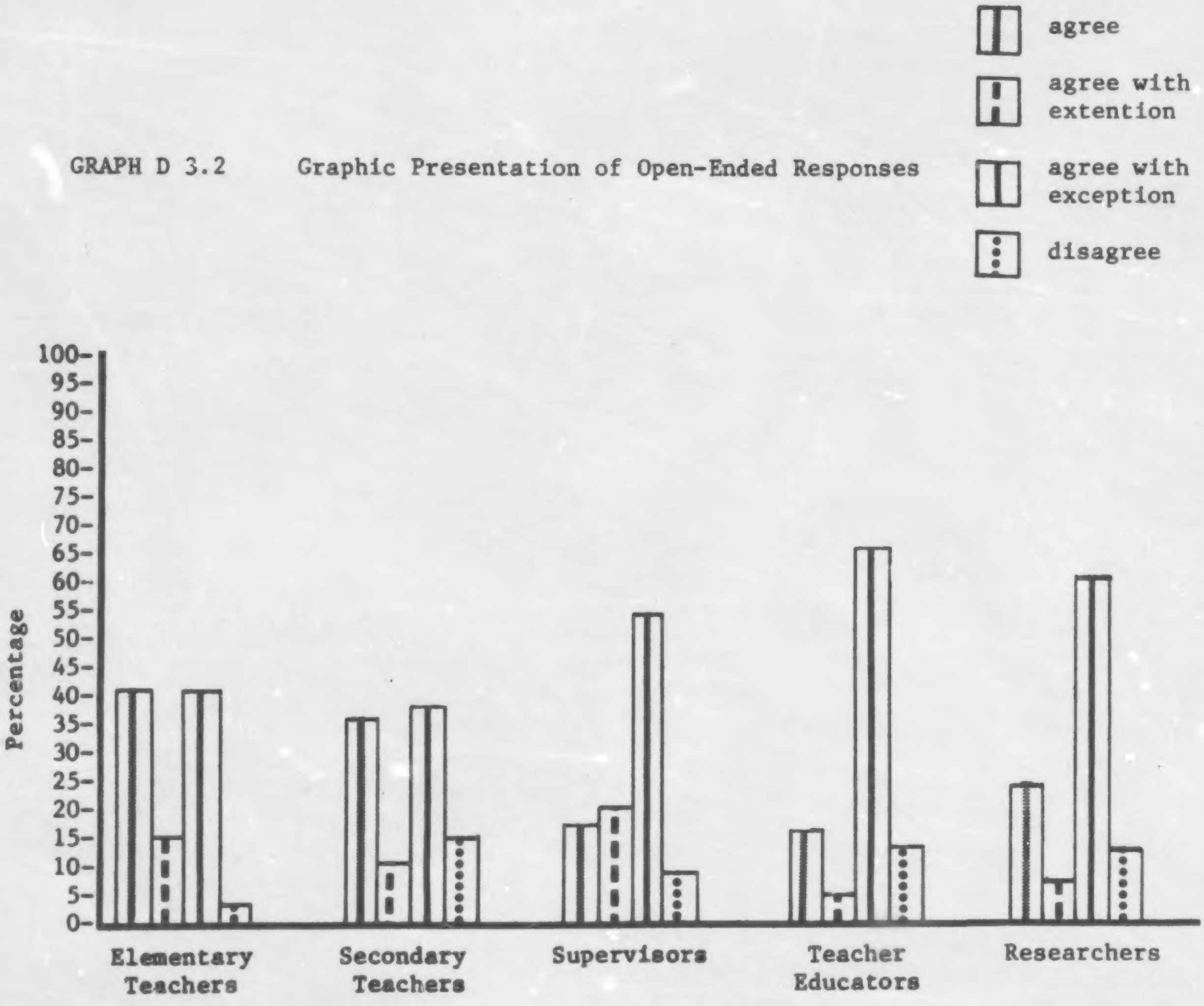


TABLE D 3.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	41	36	17	16	23
agree with extention	15	11	20	5	6
agree with exception	41	38	54	66	59
disagree	3	15	9	13	12

GRAPH D 3.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(39) (55) (46) (55) (34)

166

TABLE D 3.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	6	Should guard against cookbook activities	4
		Need to exhibit the ways of scientists	2
Secondary Teachers	6	Better students can progress rapidly in problem-oriented laboratories when solutions are not given	3
		Give students opportunity to get involved in process used by scientists to solve problems, especially inquiry discovery activities	3
Supervisors	9	This doing often leads to more doing, reading, motivation	4
		Retain more from doing than from listening	2
		Include problems that do not have pre-established outcomes	1
		Concrete reality includes the best of science	2
Teacher Educators	3	Need technical aides on all levels	3
Researchers	2	Need greatest at elementary level; found mostly at high school as long as they do not just verify discussions	2

N = Number of Respondents
F = Frequency of Responses

TABLE D 3.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	16	Any "hands on" can motivate	6
		If relevant and soluable, not too easy, not too difficult so students can see usefulness	1
		Build upon method; simple to complex; experiences in one laboratory should relate to others	5
		As long as classes are not too big or too structured	4
Secondary Teachers	21	Must be challenging, not just verify text or lecture	3
		Need to formulate hypothesis, design experiment; this as opposed to observation tends to motivate	2
		Need advanced preparation and follow-up after laboratory; depends on the teacher and good supervision	3
		Problems should be suited to proper level; can be frustrating to poor readers; should be simple enough for concrete thinker	4
		Some students prefer reinforcement-type laboratories	4
		Laboratories tend to motivate good students and frustrate poor ones (so they goof off)	5
Supervisors	25	Many laboratories are frivolous; must be skillfully conducted	7
		Use real problems, not cookbook approach--do not make too easy or too difficult	8
		Today's student difficult to motivate	6
		Need good teachers, a balance of sensory approaches	4
Teacher Educators	36	Include diversity, real problems, interesting, appropriate to level, investigative approach, inquiry oriented	8
		In theory, yes; in practice, may turn off students--not for all students, only the curious	6
		Need teacher planning, proper implementation, proper handling	7
		Laboratory should be viewed as place other than where there are lab tables and burners	4
		Real problems, extensions of events that concern students	6
		Limit to how much is meaningful	5
Researchers	20	Must be well taught	6
		Must provide cognitive understanding, investigative approach	3
		Provide real problems, not cookbooks with obvious solutions	5
		Provided solutions are forthcoming; don't frustrate students	4
		Laboratories are part of the strategy, not the total emphasis	2

N = Number of Respondents
F = Frequency of Responses

TABLE D 3.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	1	Such laboratories are not appropriate for most elementary students	1
Secondary Teachers	8	Many youngsters want immediate satisfaction; work turns them off	4
		All laboratory can be is boring	2
		Laboratories need preparation	2
Supervisors	4	Some are frustrated to the point of quitting	3
		Students not trained in observing and creative thinking get lost	1
Teacher Educators	7	Not all students like to work with hands	3
		Laboratories become time to play	4
Researchers	4	Laboratories tend to de-motivate; kids want real problems; problems are often too removed from their experience	2
		Can get just as bored with laboratories as with textbooks	2

N = Number of Respondents
F = Frequency of Responses

D 4. LABORATORIES SHOULD BE EMPHASIZED MORE BECAUSE THEY TEND TO IMPROVE STUDENT ATTITUDES TOWARD SCIENCE

TABLE D 4.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	92	88	85	75	62
disagree	4	2	3	8	8
neutral	4	10	12	17	30

GRAPH D 4.1 Graphic Presentation of Respondent Ratings

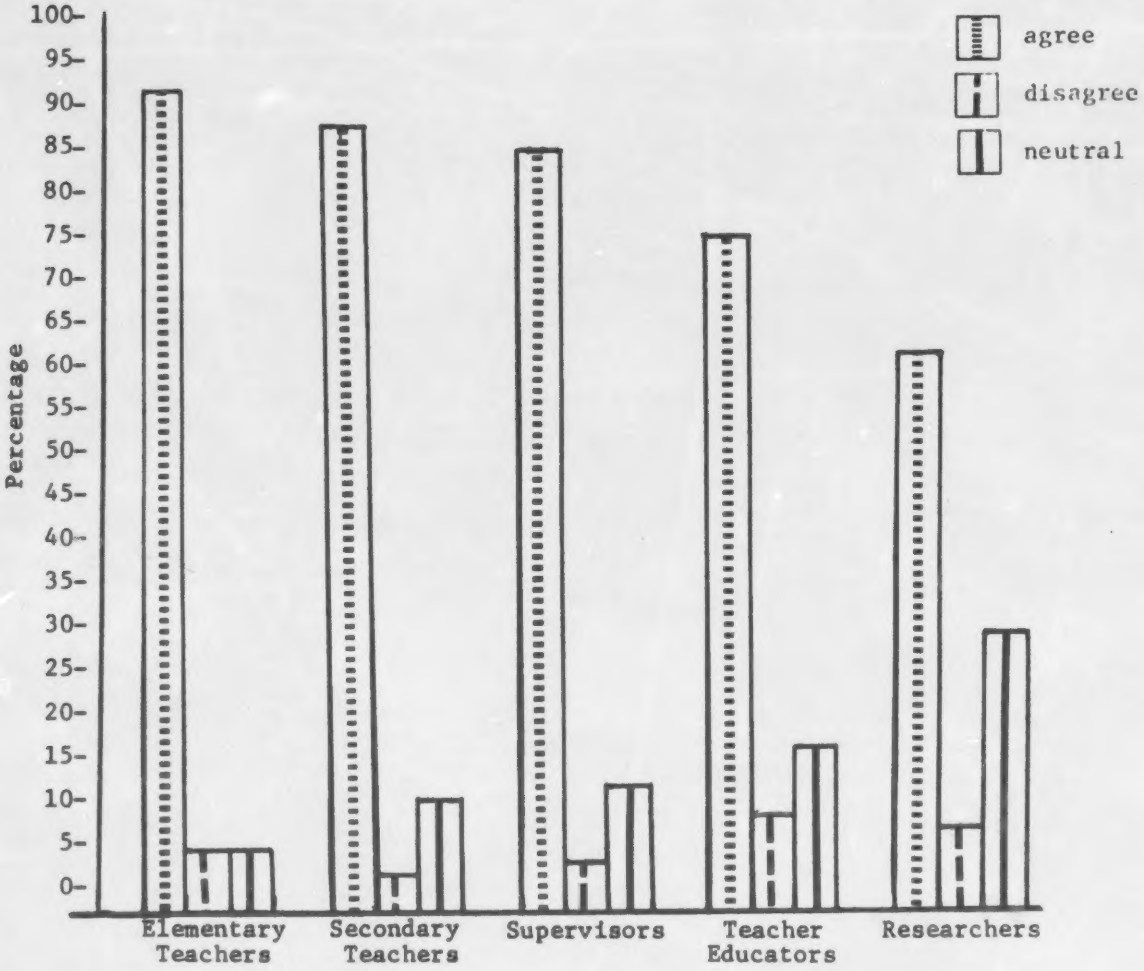
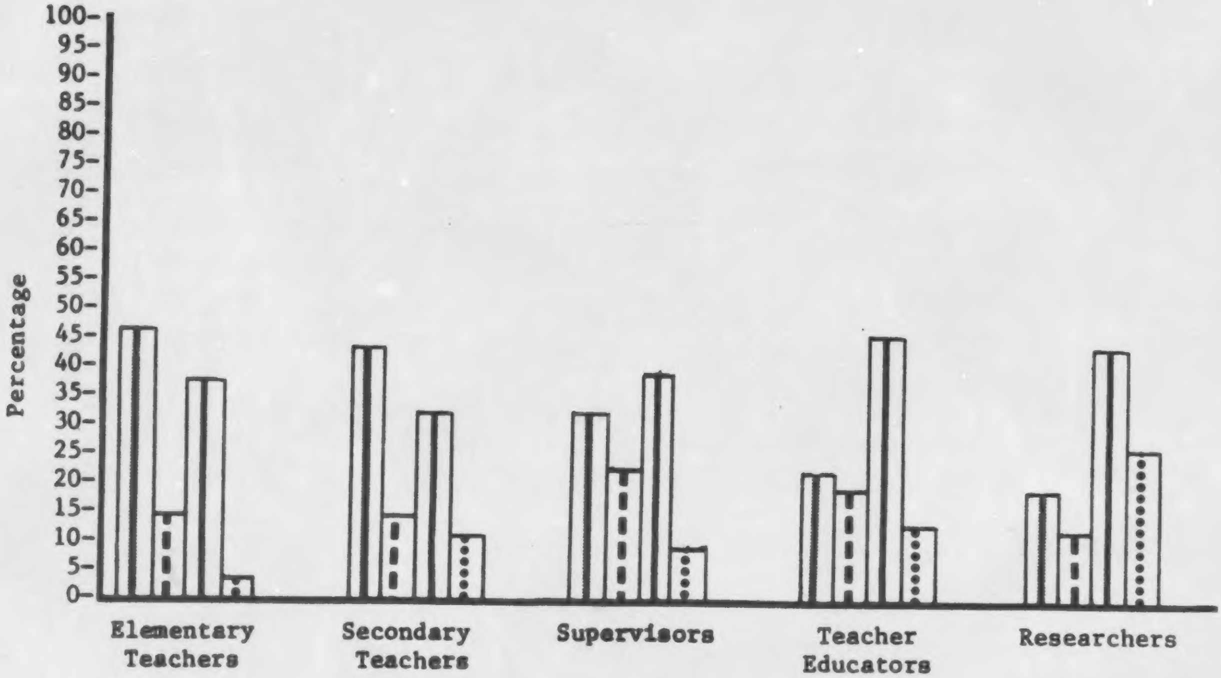


TABLE D 4.2 Categorization of Open-Ended Responses*

		Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
	agree	46	43	32	22	18
Percentage	agree with extention	14	14	22	19	12
	agree with exception	37	32	38	46	44
	disagree	3	11	8	13	26

GRAPH D 4.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(35) (44) (50) (54) (34)

TABLE D 4.3 Tabulation of Open -Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	5	Elementary schools need for science laboratories would enable a teacher to set up certain demonstrations and projects	3
		Entire child involved in learning	2
Secondary Teachers	6	If science oriented, utilize attitudes, skills	2
		Cost more, but only way to interest future scientists; show how scientists operate; emphasize relevance	3
		Stimulates interest; active experience	1
Supervisors	11	Students identify with science labs as the aspect they like best; attitudes and motivation are correlated	3
		Labs should include field experience	3
		Cookbook verification can cause negative attitudes	4
		Help students to see things as they are; separate fact from judgment	1
Teacher Educators	10	Without inquiry, laboratory students cannot develop an accurate attitude or understanding	3
		Particularly when laboratories are meaningful and relate to the students' experiences	4
		If quality of laboratory and teaching is good, it will create good attitudes	3
		Problem is teacher related	3
Researchers	4	Actively publicize supportive evidence	4

N = Number of Respondents
F = Frequency of Responses

TABLE D 4.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	13	Hands on better learned; more student on task learning	4
		Need proper laboratories, not playground, with good teacher, not good assistant, aide or intern	3
		Greatest determinant of attitude is teacher	4
		If structured properly and not too difficult	2
Secondary Teachers	14	Teacher sets tone, so needs to be trained - should be learning session, not indoor recess; students don't like meaningless work	9
		Too many can be bad; students like change; activity oriented learning requires discipline; depends on type of laboratory	5
Supervisors	19	General statement depends on laboratory	6
		Laboratory could and should do more to foster positive attitude; depends on teacher's flair for laboratories	5
		True science is motivating; most laboratories are routine, have little effect on attitudes	4
		Depends on quality of labs; must be pragmatic and contemporary	2
		Laboratories show what science is; mismanagement causes bad attitudes	2
Teacher Educators	25	Depends on competent management; must be well-taught; need more prepared teachers	4
		Laboratories show what science is; mismanagement can create bad attitudes	8
		Depends on laboratory activities; should be interesting investigations, not busy work or cookbook confirmations	6
		Student directed, inductive, with experiences that generate honest data will prove worthwhile	7
Researchers	15	Depends on nature of laboratory	5
		Must define meaning of term laboratory	5
		May differ for different students and different types of activities	5

N = Number of Respondents
F = Frequency of Responses

TABLE D 4.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	1	Cannot say laboratories are not generally used at the elementary level	1
Secondary Teachers	5	Learning should be geared to student level	1
		Investigative labs require small teacher/pupil ratio	2
		Students regard laboratories as extra; avoided by students	1
		If this had been written in the 50's, it would have been regarded as forward-looking	1
Supervisors	4	Many laboratories do not support this	3
		Some students would rather sit than be forced to find meaning in collected data	1
Teacher Educators	7	Studies show different results	4
		True for science prone; others have difficulty interpreting data and drawing conclusions	3
Researchers	9	Need more research	5
		Laboratory practices differ as to how taught	4

N = Number of Respondents
F = Frequency of Responses

D 5. TRADITIONAL OFFERINGS SHOULD BE EXPANDED AND ORGANIZED IN WAYS OTHER THAN BY DISCIPLINE

TABLE D 5.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	78	59	60	79	62
disagree	9	26	16	12	8
neutral	13	15	24	9	30

GRAPH D 5.1 Graphic Presentation of Respondent Ratings

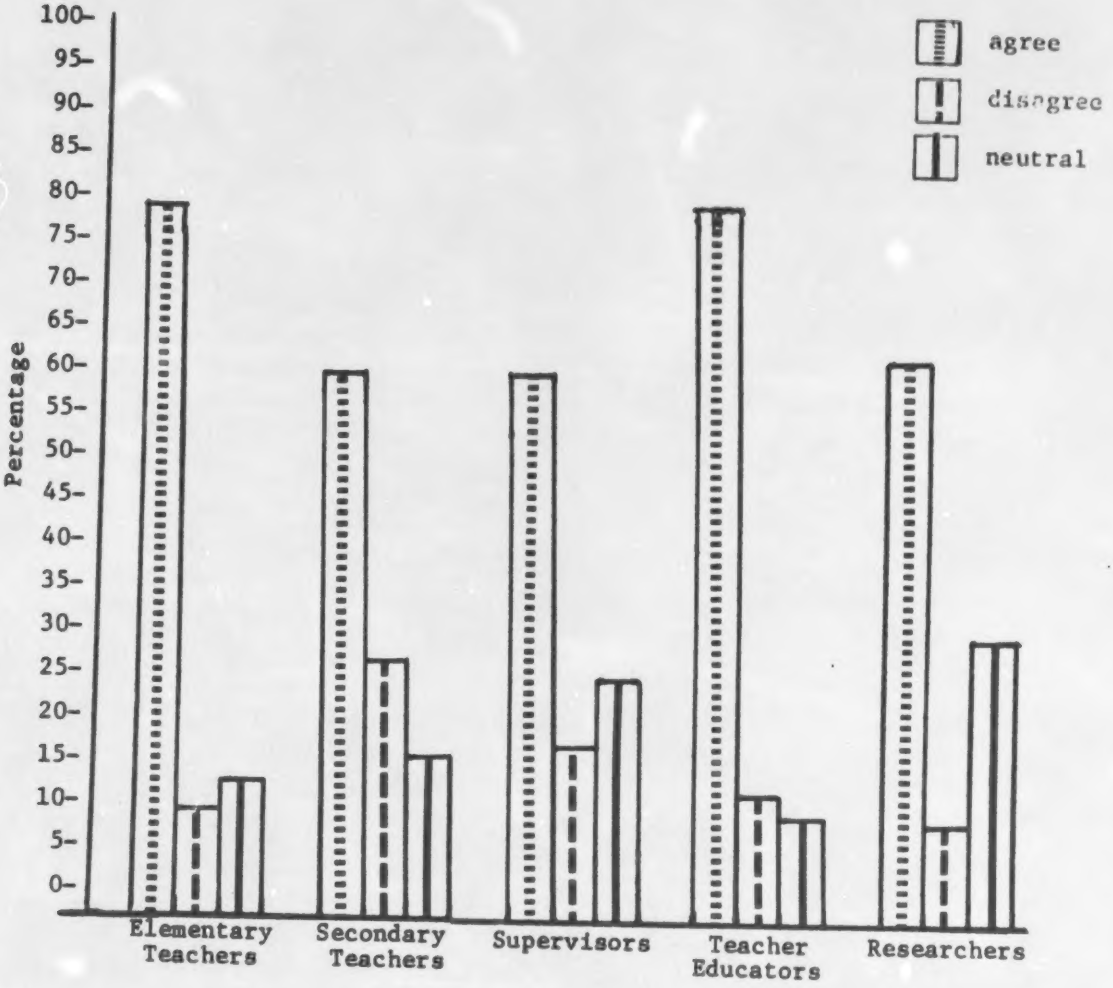


TABLE D 5.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	26	19	14	21	30
agree with extention	47	21	25	12	18
agree with exception	12	23	36	45	42
disagree	15	37	25	22	10

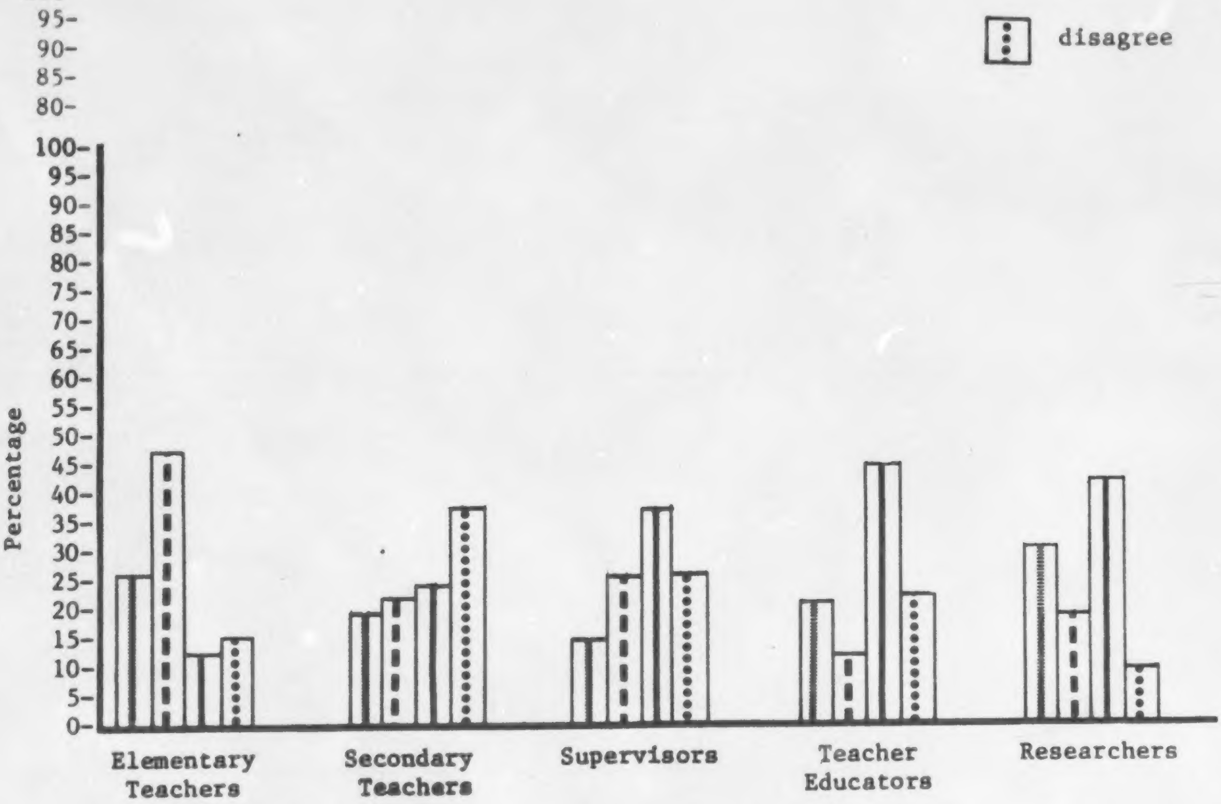
▯ agree

⁞ agree with extention

▯ agree with exception

⁞ disagree

GRAPH D 5.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(34)	(48)	(51)	(58)	(40)

TABLE D 5.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	16	More emphasis on environment	4
		Branches of biology and earth science should be explored; value-oriented course electives offered	4
		Unified science movement, relevant to students, mini courses	3
		Stress vocabulary definition and use	2
		Biology by another name could be more exciting and enticing	2
		Pretests, consider language, individual instruction sheets through all grades	1
Secondary Teachers	10	Mini courses a good way to extend traditional offerings; general science courses will bridge the gap	2
		Should remain a separate subject	2
		Need to offer more in astronomy, oceanography, and meteorology	2
		Unified science especially 9 and 10; interrelationship with other areas	2
		High schools need their entire programs overhauled	2
Supervisors	13	Review program in terms of "what knowledge is of most worth"	2
		Must serve all students, not just the college bound	4
		Humanities approach could be used	2
		Faster and harder is not always the best way to go	2
		Science is a discipline; unification of sub-disciplines is needed	3
Teacher Educators	7	Redesign as student-centered; cross discipline; open-access separation into disciplines is counterproductive	2
		Eliminate single course syndrome; use mini courses and interdisciplinary core, especially for non-science oriented students	5
Researchers	7	Especially for those not electing physics, chemistry, and other academic courses	4
		Use problem approach; organize around unifying concepts	3

N = Number of Respondents
F = Frequency of Responses

TABLE D 5.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	4	Not all programs, just for certain groups	4
Secondary Teachers	11	Can become too generalized; student lose interest	3
		Most teachers are subject matter specialists; can't expect them to teach everything	4
		Need two main tracks for college to non-college; one program K-8 and discipline approach 9-12	4
Supervisors	18	Only up to grade 10-12 where basic information needs to meet competition	4
		Some disciplinary features must remain and both coexist	3
		Creative science should take the lead	3
		Difficult to do with ingrained traditional thinking	2
		Easily done for non college bound, but not for college bound (college must change requirements)	3
		Can cause people to deviate from teaching science	2
		Funding restricts achievement	1
Teacher Educators	26	Requires careful study of societal needs and goals of education	8
		Maintain traditional courses as one track	3
		Integration of several disciplines takes much staff time	5
		Need to change teacher preparation	2
		Need to be careful to maintain conceptual organizations and emphasize inquiry; include earth and space science	3
		Suited to non-college bound students	2
		Desirable, but difficult to do	3
Researchers	17	Need new organization, new methodology, and teacher education	5
		Keep in realm of inquiry; give options	4
		Difficult to do with declining enrollments, not essential to interesting science program	3
		A specific time frame is a problem	1
		For older students after foundation has been laid	2
		Emphasis should be on improving learning experiences in introductory courses	2

N = Number of Respondents
F = Frequency of Responses

TABLE D 5.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	5	Choices only if they meet prerequisites	2
		Not until colleges change	2
		Teaching is the problem	1
Secondary Teachers	18	Chemistry prior to biology	3
		Do not abandon big ideas	4
		Can weaken programs if they omit science and get too expanded	5
		No programs or research opportunities for brighter kids	3
		Current sequence of earth science, biology-chemistry-physics is best for concrete students	3
Supervisors	13	Doubtful, science community organized along discipline lines	4
		Ensure that basic concepts and knowledge show up in courses	5
		Could be superficial	2
		Do not expand, reorganize at lower level; improve the current organization	2
Teacher Educators	13	Too few students study science already	3
		We are losing science relevance	2
		Teacher training would have to change	4
		Cannot diversify too far or spread resources too thin	4
Researchers	4	Expanded but not in ways other than by discipline	2
		Teacher is the key; programs are but vehicles	2

N = Number of Respondents
F = Frequency of Responses

D 6. SCIENCE IN COMMUNITY COLLEGE TENDS TO BE MORE FLEXIBLE AND VARIED THAN IN K-12 SCHOCLS

TABLE D 6.1 Result of Respondent Ratings

		Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
Percentage	agree	62	54	53	46	51
	disagree	6	22	15	25	22
	neutral	32	24	32	29	27

GRAPH D 6.1 Graphic Presentation of Respondent Ratings

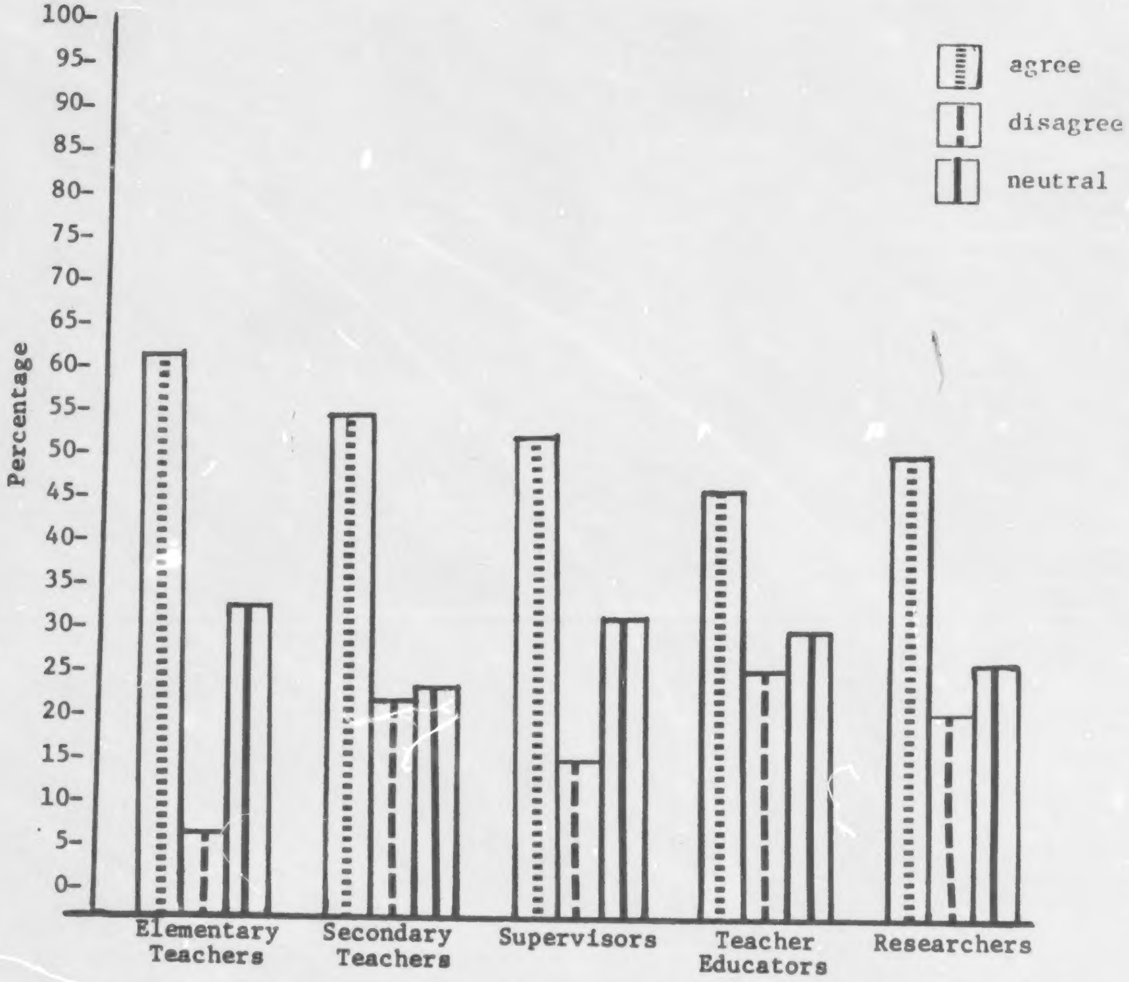
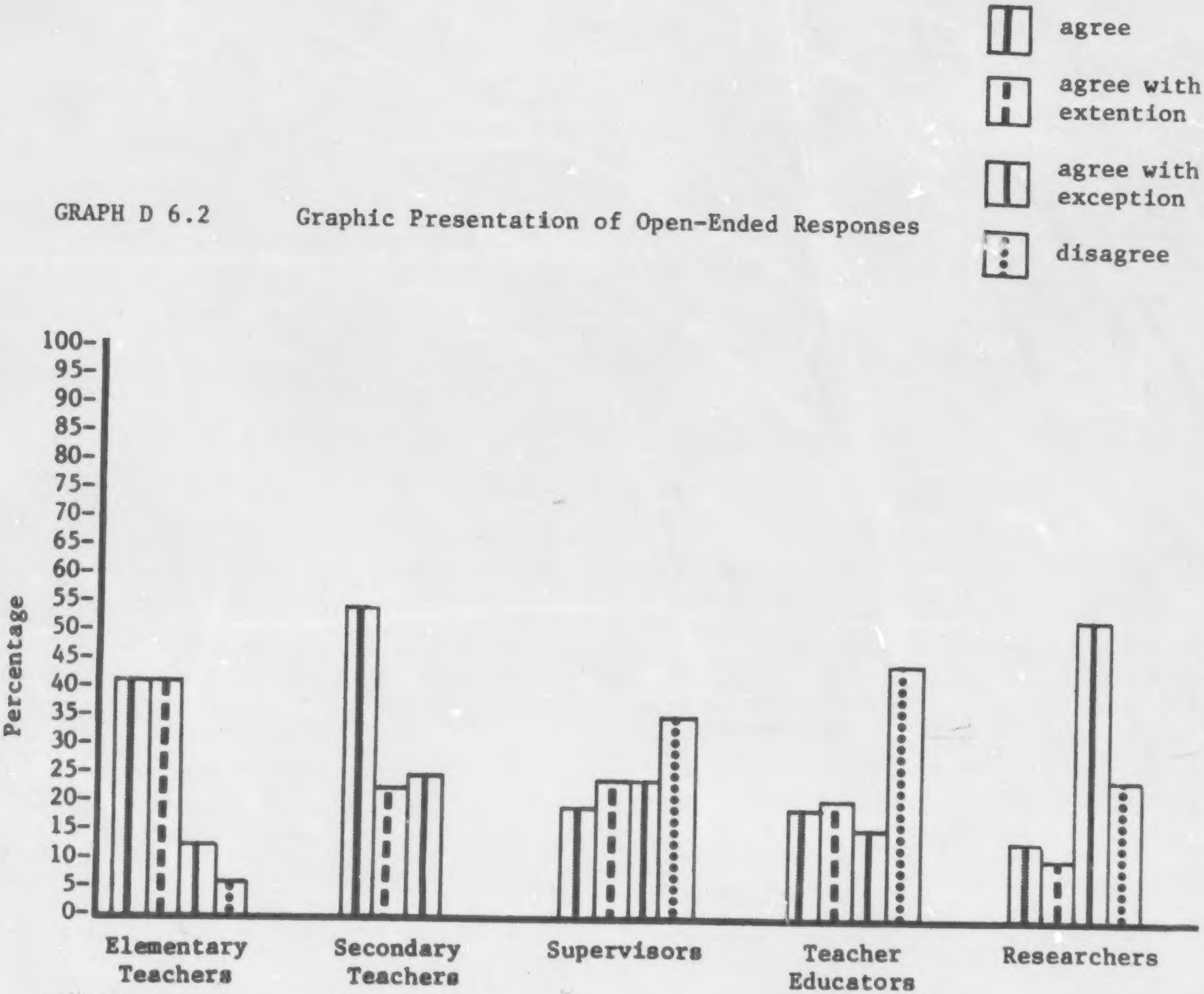


TABLE D 6.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	41	54	19	19	13
agree with extention	41	22	23	21	10
agree with exception	12	24	23	15	52
disagree	6	0	35	45	25

GRAPH D 6.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(34) (50) (43) (53) (31)

TABLE D 6.3 Tabulation of Open-Ended Responses Which Extend the Postion

Group	N	Summary of Responses	F
Elementary Teachers	14	Important if student has inadequate science training	5
		Students are enrolled because they want to	5
		Promote continuing relationship of all science teachers	4
Secondary Teachers	11	More variety; many courses individualized approaches	5
		Less tradition to hamper new varied programs, practical programs	3
		Numerous technological programs also non-credit course offerings	3
Supervisors	10	Local community colleges are experiencing rise in science enrollments	3
		Compatible with philosophy of community college	2
		Up to leaders to sell teachers on the idea that they can and must meet the challanges	3
		Technical education is the key for real world jobs	2
Teacher Educators	11	They survive because they meet the needs of varied clientele with a varied curriculum; colleges give "passports" into certain jobs	3
		Science programs vary greatly	3
		Cost of four year college will mean more use of two year schools; need to improve articulation of programs at four year colleges and improve two year college offering	3
		Include science programs from pre-professional to adult learner	2
Researchers	3	Attribute to less academic orientation; people seldom intent on being scientists	3

N = Number of Respondents
F = Frequency of Responses

TABLE D 6.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	4	But important at college level also	4
Secondary Teachers	12	Universities and high schools can share in this diversity	3
		As long as students are carefully guided in suitable course selections	2
		More subjects, less varied teaching methods	2
		Need enough students to separate the beginners from the experienced into small classes	2
		They do not need any more than universities	3
Supervisors	10	Some do, some do not: there is a great variety in some - flexibility exists	3
		This implies academics are missing	2
		Flexibility is needed	5
Teacher Educators	8	True in some cases, but often similar to colleges	4
		Cannot provide the variety of four year colleges	4
Researchers	16	Have potential to do so; varies from place to place	6
		Flexibility occurs but courses often watered down; students expected to integrate knowledge they haven't acquired	4
		Include vocational courses; need better and different staffing	6

N = Number of Respondents
F = Frequency of Responses

TABLE D 6.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	2	Not necessarily	2
Secondary Teachers	0		
Supervisors	15	They should, but really they do not	6
		Tend to be taught at a high school level; remedial sessions for poor high school students	4
		Trying to reach a consumer that was missed in high school	1
		Look just like four year colleges	4
Teacher Educators	24	In many cases science taught here is most conventional and inflexible, watered down	11
		Not as they are organized and taught now	4
		Very little difference; trying to emulate the four year colleges and universities	9
Researchers	8	Does not represent most flexible academic offerings; some exist where there is more flexibility, but these more involved in adult education	5
		They mimic offerings at four year colleges	3

N = Number of Respondents
F = Frequency of Responses

D 7. LABORATORIES SHOULD BE VITAL PARTS OF SCIENCE EDUCATION AT THE COLLEGE LEVEL

TABLE D 7.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	90	90	89	83	64
disagree	2	3	5	7	18
neutral	8	7	6	10	18

GRAPH D 7.1 Graphic Presentation of Respondent Ratings

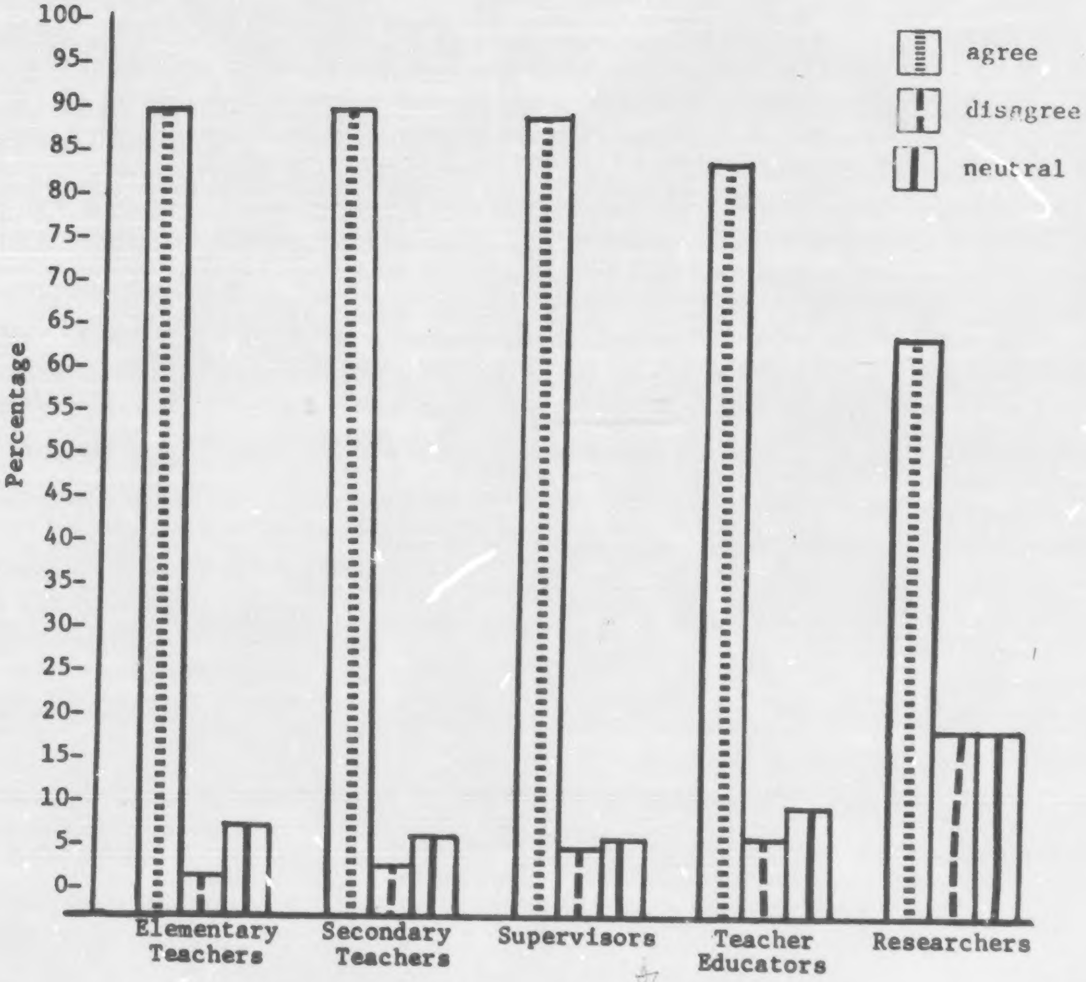


TABLE D 7.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	41	42	40	27	12
agree with extention	15	22	24	20	10
agree with exception	29	22	29	33	41
disagree	15	14	7	20	37

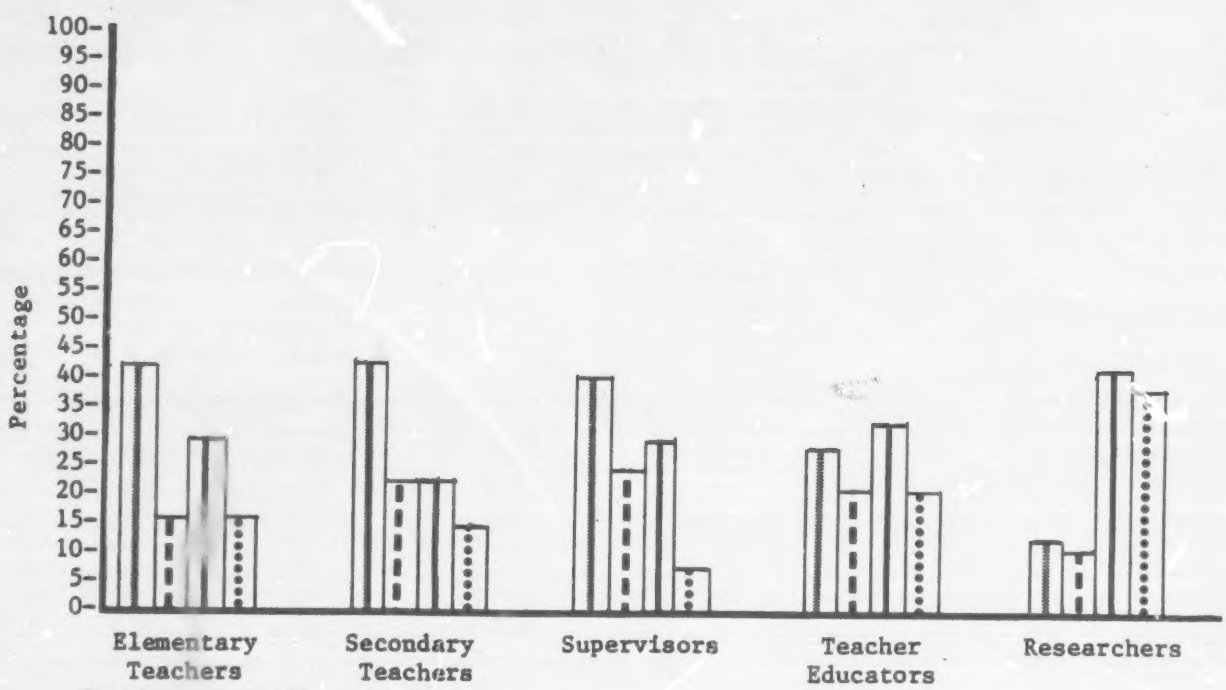
▥ agree

▯ agree with extention

▯ agree with exception

⋮ disagree

GRAPH D 7.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(39)	(55)	(55)	(64)	(41)

TABLE D 7.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	6	If more laboratories were in introductory courses, more students would take science	3
		Traditional laboratories might not be as feasible as creative groupings; need to brainstorm	3
Secondary Teachers	12	College science classes need to be smaller, especially laboratories and introductory courses	4
		Continue high school labs in college; how else will teachers be trained to teach laboratories	4
		Laboratories needed to bring concrete meaning to abstract ideas; more open-ended	4
Supervisors	13	More inquiry oriented laboratories; demonstrative laboratories optional	4
		Must reverse trend for those who do not go beyond the introductory courses	3
		College professors are "lazy" scientists	1
		With research assistant "slaves" to do their work	3
		Laboratories should not be taught as separate classes	2
Teacher Educators	13	Need experiences early in education	3
		Creates feeling that "that's what scientists do," not everyone solving problems	3
		Leads to superficiality and acceleration of scientific illiteracy	3
		Carefully selected experiences which convey the laboratory processes as fundamental way of knowing	2
		Anti-science professors do not understand essence of science or their students	1
		Especially important for preservice science teachers who teach as they are taught	1
Researchers	4	Without laboratories, most lecture content is forgotten; people remember with hands on	2
		Field independence should result in different college laboratory experiences	2

N = Number of Respondents
F = Frequency of Responses

TABLE D 7.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	11	Depends on depth of course	3
		Need laboratories relevant to non science majors; need better laboratories, not professors' "pet" projects	2
		This is level where laboratory work and creative research are needed	3
		Conflict of budget and large classes	3
Secondary Teachers	12	Not in all courses; depends on type, not survey courses; laboratories done poorly generally good for those going into research	2
		College professors must recognize that they do not introduce science to students	3
		Only when used in tandem with lectures; include hands on	2
		Easier to teach massive classes without a lab, too much work and preparation	3
		Science teachers should include methods of classroom application	2
Supervisors	16	Many students are not lab-oriented	5
		Laboratories are the working place of scientists, not most citizens	5
		Should relate to real world	6
Teacher Educators	21	Laboratories must be creative and fresh in design; many are not	5
		Both laboratory and non-laboratory have a place; laboratories have been ineffective in some situations	4
		Many poorly taught by graduate students with no education background	2
		Maybe non-science majors do not need labs	2
		Many do not promote ideal laboratory approaches	3
		Relate to real life problems with application; dissecting cats, clams, earthworms is a waste of time	3
		No program is teacher proof; money is a limiting factor; larger classes and smaller budgets are problems	2
Researchers	17	Poor organization and not focusing on origin of knowledge can make them deadly	6
		Trend towards fewer; nature of laboratory is important; need better instruction and investigative approach	3
		Many students avoid labs	5
		Do not forget the important aspects of general education and teacher education in science	3

N = Number of Respondents
F = Frequency of Responses

TABLE d 7.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	6	Only researchers need this	1
		Other communication such as tapes, films, T.V., video tapes can replace some labs	2
		If community college can offer multi media non-laboratory science, why can't other colleges?	3
Secondary Teachers	8	Little thought goes into introductory laboratory courses; a waste of time for students	4
		Colleges should decide how it is taught at their level	2
		Good for introductory courses; some may just be taking for requirement	2
Supervisors	4	Leave it to the experts	2
		Merely one of the traditions	2
Teacher Educators	13	As long as science teachers consider themselves scientists and not educators, they will continue to ignore science education departments	2
		Fewer laboratories need to be accommodated by societal science related issues	2
		Laboratories only meaningful if they generate honest data	2
		The whole idea of college laboratories is counter to the way science is usually done	3
		If used for verification, they are a waste of time; not needed if junior high and high school had good labs	2
Researchers	15	Only if students have not had good laboratory experience prior to this	2
		The role, structure, and function of laboratories need serious reconsideration	3
		No evidence that laboratories are of real value in meeting any goal of science education	6
		Too many college laboratories are not investigative and therefore give an inaccurate view as to what science really is	4

N = Number of Respondents
F = Frequency of Responses

D 8. ALL ELEMENTARY TEACHERS SHOULD COMPLETE FORMAL STUDY IN THE EARTH, PHYSICAL, AND BIOLOGICAL SCIENCE AREAS

TABLE D 8.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	77	85	82	58	54
disagree	13	8	6	31	35
neutral	10	7	12	11	11

GRAPH D 8.1 Graphic Presentation of Respondent Ratings

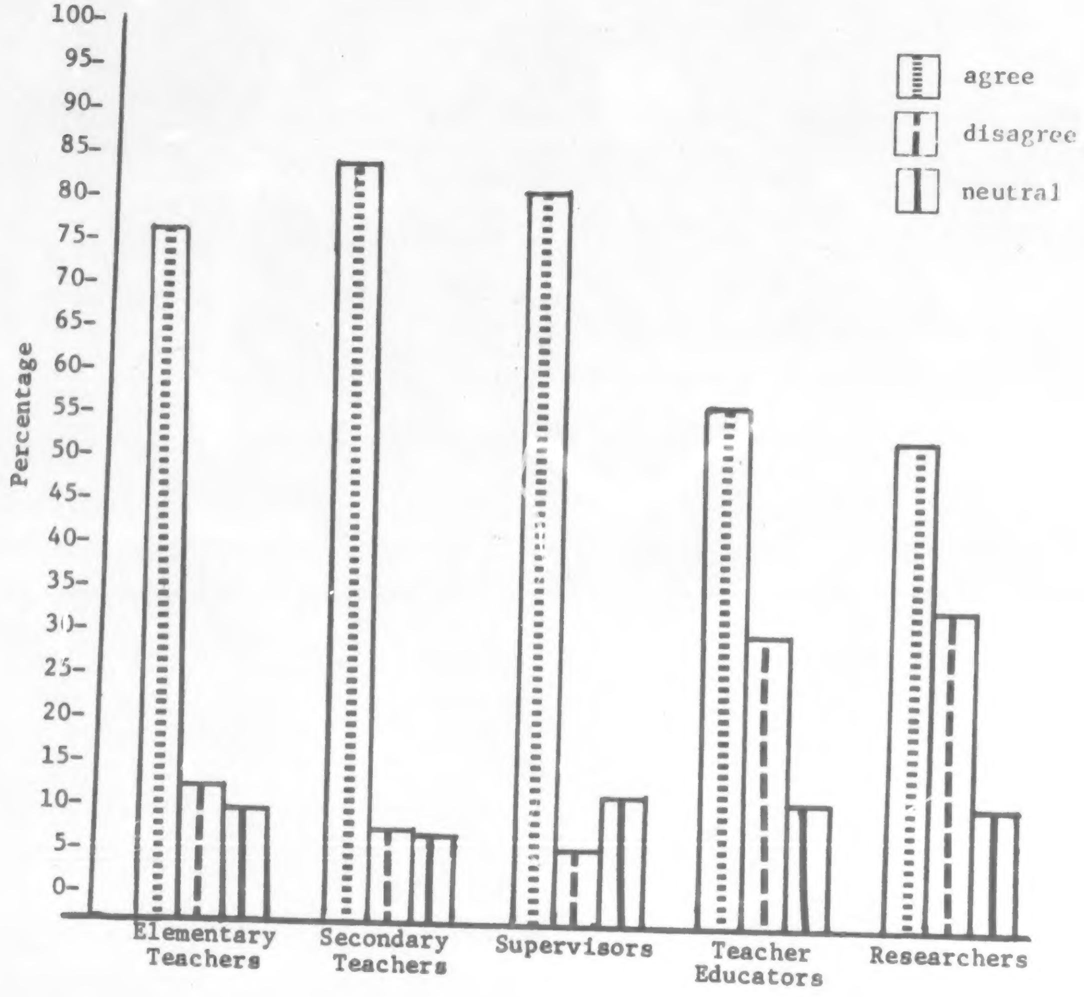
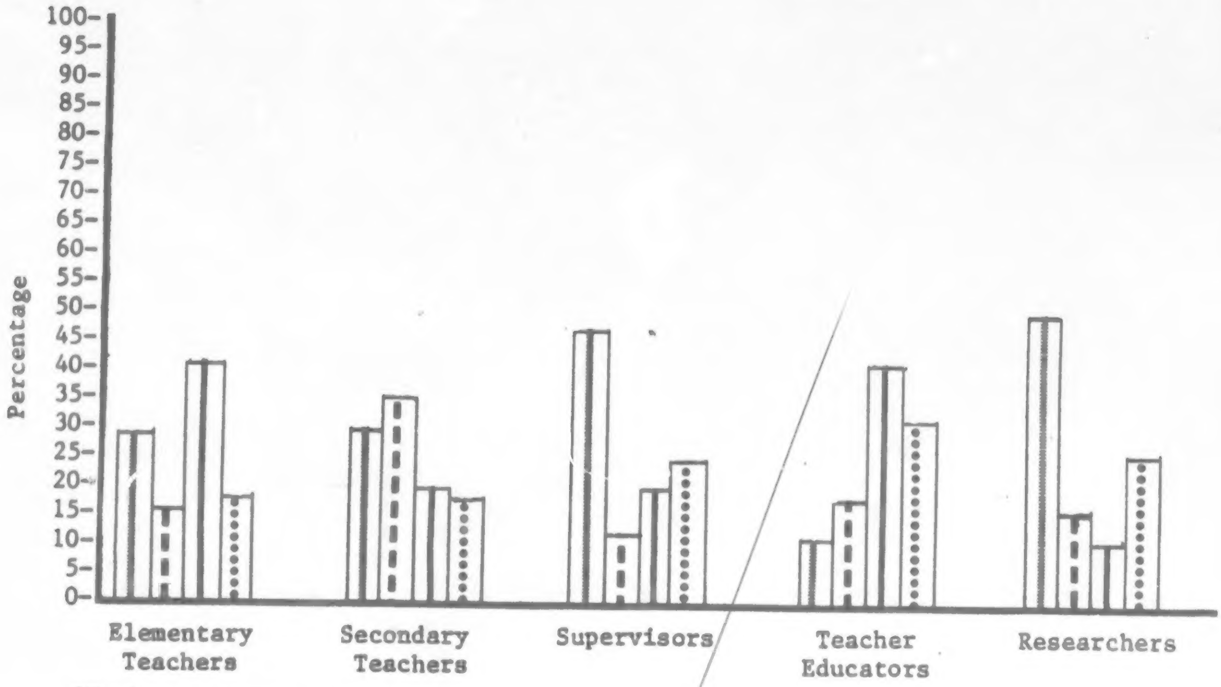


TABLE D 8.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	28	29	46	11	50
agree with extention	15	35	11	17	15
agree with exception	40	19	19	41	10
disagree	17	17	24	31	25

▯ agree
▯ agree with extention
▯ agree with exception
⁞ disagree

GRAPH D 8.2 Graphic Presentation of Open-Ended Responses



*Numbers Provic ing Comments

(47)	(48)	(57)	(46)	(40)

TABLE D 8.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	7	Broad knowledge background can be used to stimulate students	3
		More departmentalized subjects, including teaching experience and learning by doing	2
		Proper background gives basis for career	2
Secondary Teachers	17	Students need a good start with an enthusiastic, knowledgeable teacher	4
		Reading is important in early grades and science materials can help	4
		Emphasis on unified science; need a taste of all science they will teach	3
		More background in science will make them more comfortable	6
Supervisors	6	Need preparation in content processes as well	3
		Could be structured into a general science course that stresses application	3
Teacher Educators	8	Need a special kind of science to relieve fears	3
		Need to know how simple systems can be investigated	1
		Physical science instruction is particularly a problem	2
		Must be able to make science curriculum decisions, not just teach day-to-day	2
Researchers	6	Also for secondary; should have special courses designed for them in three general areas	4
		Must be investigative	2

N = Number of Respondents
F = Frequency of Responses

TABLE D 8.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	19	Need courses geared to appropriate levels	4
		Need more dealing with present elementary information	4
		Must be relevant to elementary teachers' needs	3
		Fear of science due to lack of background in content	3
		If a relevant focus; perhaps a workshop format	3
		Probably do not need all	2
Secondary Teachers	9	Methods and processes are more important than content	5
		Need to have good experiences in some areas, perhaps a choice	4
Supervisors	11	Colleges have little interest in providing necessary elementary programs	4
		Teach them how to adapt knowledge to their future classrooms	4
		Need to avoid T.V. and typical graduate students	3
Teacher Educators	19	Courses need to be different from those offered for other college students	4
		Completing credit hours does not improve instruction	5
		Only necessary if they are going to teach science	3
		Include junior and senior high school teachers too	3
		It is more important that the experience is investigative science	4
Researchers	4	Unless they study these in an inquiry environment, they may do more harm than good	4

N = Number of Respondents
F = Frequency of Responses

TABLE D 8.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	8	Do not want to be science specialists; want to be specialists in educating children	5
		Entirely impractical	3
Secondary Teachers	8	One science course should be required of all college students, one using interdisciplinary approaches would be most effective	5
		Students do not have time because of other course requirements	3
Supervisors	14	Should not have science as special discipline, but as interdisciplinary experience	2
		How to help improve student attitude is more important	2
		Problem solving and other instructional skills are more important	4
		If too rigorous, will not be any teachers	3
		Only need methods of teaching science by top quality, motivated teachers	3
Teacher Educators	14	Impossible to achieve	2
		Creates same problems as with secondary and college teachers	4
		Gain more from interdisciplinary studies, not separate courses; elementary teachers tend to shy away from science	5
		Having other course requirements prevent this	3
Researchers	10	Problems lies in using science learned in the classroom in teaching; need special courses designed for elementary education majors	4
		Emphasis on unified science courses instead of sampling several disciplines	3
		Given other requirements, this is not realistic	3

N = Number of Respondents
F = Frequency of Responses

D 9. CORRECTING INADEQUATE SCIENCE PREPARATION SHOULD BE A MAJOR PRIORITY FOR TEACHER EDUCATION STUDENTS

TABLE D 9.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	84	73	67	53	49
disagree	6	19	17	32	41
neutral	10	8	16	15	10

GRAPH D 9.1 Graphic Presentation of Respondent Ratings

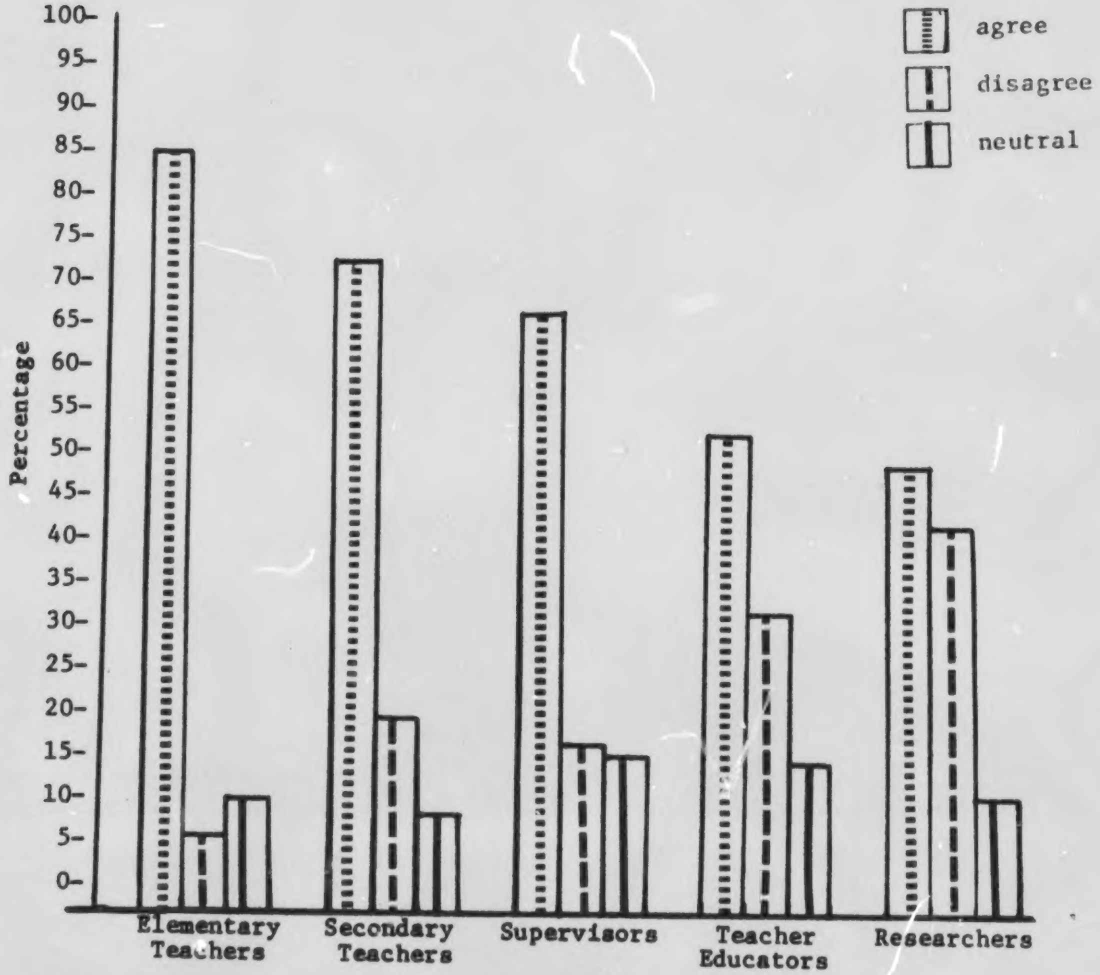
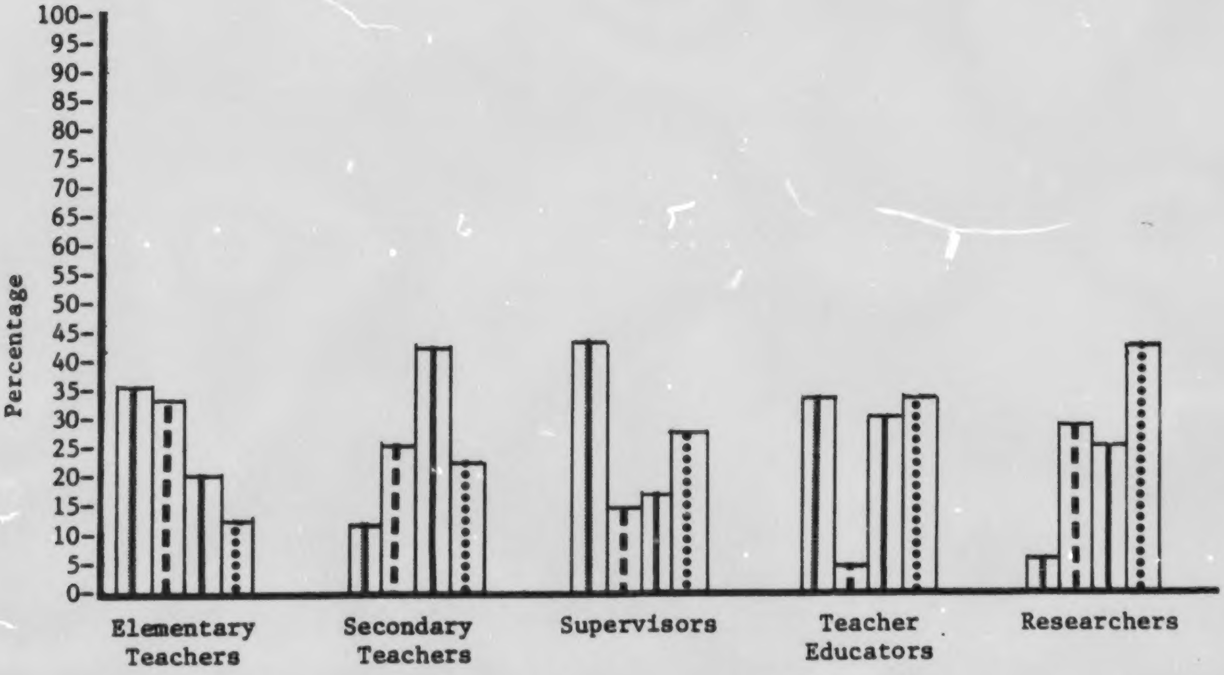


TABLE D 9.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	35	11	43	33	5
agree with extention	33	25	14	4	28
agree with exception	20	42	16	30	25
disagree	12	22	27	33	42

GRAPH D 9.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
(40)	(36)	(56)	(51)	(36)

TABLE D 9.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	13	Teachers without experience in science reluctant to teach it	3
		Teachers, especially K-6, need something they can understand and use with students	4
		Too many existing elementary teachers are lacking in the simplest aspects of science	3
		Content, hands on, process, and methodology should be emphasized	3
Secondary Teachers	9	Science should be taught only by those who specialize in science	4
		Only those who major in science get enough science background	3
		Probably not enough training in inquiry methods	2
Supervisors	8	Must separate teachers who teach single discipline from those who must teach several	3
		Preparation in science is a foundation for all teachers	5
Teacher Educators	2	Should include understanding of science and its place in society	2
Researchers	10	Lack of experience with investigative science is a major problem	3
		Need to agree on definition of quality science instruction	4
		Not only adequate, appropriate and amount required	3

N = Number of Respondents
F = Frequency of Responses

TABLE D 9.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	8	Not everyone wants to teach science	4
		Some preparation can be in too much depth	4
Secondary Teachers	15	Need to be sure content appropriate for teacher at any given level	3
		Some content is important, but science methods are also important	2
		Too many institutions are involved with teacher education in the US	2
		Content should vary with the student taught	2
		Problems occur when teachers have to teach outside area of expertise	3
Supervisors	9	Need for elementary, not secondary	3
		Also need experience that will help create positive attitudes	2
		Science certification for K-12 like art and music would be good; many have enough hours, but wrong type of courses comprising them	4
Teacher Educators	15	Bigger failure in lack of pedagogy	3
		Teachers have poor knowledge of scientific process and negative attitudes	3
		Need courses that make sense, such as interdisciplinary ones and ones stressing use of knowledge	2
		Appropriate courses should emphasize ideas that can be used in teaching, not just information needed for medicine	3
		Needed for elementary; not needed for secondary	2
		Problem in K-9, not 9-12	2
Researchers	9	Do not need extensive preparation in traditional science offerings	5
		True for most elementary; adequate for higher levels of 7-12	3
		Better high school science would help	1

N = Number of Respondents
F = Frequency of Responses

TABLE D 9.5 Tabulation of Open-Ended Responses Which Disagree with Postion

Group	N	Summary of Responses	F
Elementary Teachers	5	Few teachers are prepared in all areas	3
		Content is only one needed for preparing good teachers	2
Secondary Teachers	8	Too many college science courses are geared for pre-med and specialists	4
		Need process skills and practical experiences more	3
		Too few "practical" science courses available	1
Supervisors	15	Greater need for preparation in the nature of science, learning stages of children, technology, science and society	2
		Teachers tend to imitate college professors; lecture/demonstration, with no laboratories	3
		Science teachers usually taught in non applied manner	3
		9-12 science teachers specialize too much; need broader education	4
		Elementary teachers can teach with little or no preparation in science	3
Teacher Educators	17	Teachers often teach out of area of interest and expertise	1
		Emphasis on structure of disciplines has killed interest in science; it is not appreciated	3
		More content is not key to effectiveness; need more help with instructional procedures	13
Researchers	15	Many traditional courses in typical college curriculum are unlikely to be helpful	11
		College science instructors are extremely poor models of effective teaching for K-12	4

N = Number of Respondents
F = Frequency of Responses

TABLE D 10.1 Tabulation of Open-Ended Responses Which List Other Major Problems with Teacher Education Programs

Group	N	Summary of Responses	F
Elementary Teachers	56	Sources of good classroom materials	3
		Programs for adequate content preparation	5
		How to be effective with inadequate budgets	2
		Poor college models for effective teaching	4
		More time for field experiences	3
		Help with experimental projects	2
		Practice with student motivation	2
		How to deal effectively with larger class sizes with all subjects	2
		Ways of dealing with administration	2
		Information on how students learn	3
		Preservice - inservice continued	1
		Relating sciences to other disciplines	3
		Practice with inquiry skills	7
		Ways of affecting student attitudes	3
		Teacher as a model	2
		Applications of science in daily living	4
		Gaining a balanced program	4
		Dealing with student interests	4
Secondary Teachers	58	Logistics for teaching	8
		Materials for teaching	1
		Teaching attitudes of science	1
		Writing skills	2
		Preparation for inquiry teaching	4
		Features of scientific literacy	2
		Information on how people learn	7
		How to deal with administrators	2
		Real experiences with science	2
		More field experiences instead of typical education course	1
		Laboratory skills	4
		Rote learning required in college science	3
		How to teach with limited budgets	3
		Understanding real nature of science	3
		Improving learning (teaching) climates	2
		Dealing with applications of science	4
		Improved college science experience	2
		Involve instructors who have been recently (or are currently) involved as teachers	2
		Dealing with non-caring colleagues	2
		Knowledge of pseudo sciences and procedures for combating it	2
Supervisors	54	Skill with integrating science and with science applications	3
		Integration of science with other disciplines	3
		Teacher experience with real science (laboratory)	2
		Knowledge of laboratories and research information	2

N = Number of Respondents
F = Frequency of Responses

TABLE D 10.1 Tabulation of Open-Ended Responses Which List Other Major Problems with Teacher Education Programs (continued)

Group	N	Summary of Responses	F
Supervisors continued		Practice with self learning	2
		Using teacher planning periods more effectively	1
		Help with dealing with handicapped students	4
		Help with dealing with students instead of science content	6
		Techniques for motivating	2
		Laboratory techniques	2
		Articulation between colleges and secondary schools	1
		Lack of preparation in college for non-science teachers and administrators	4
		Real science processes	6
		Human relations	2
		Commitment to teaching, to students, and to application of science	4
		Factors affecting attitudes	5
		Values of science	3
Teacher Educators	54	Encouraging more formal thinkers to become teachers	4
		Skill with developing improved attitudes toward science	5
		Need more college work with goals; translating them into meaningful learning	3
		Perceptions of Science as a process rather than a product	4
		Pros and cons of merit pay	2
		Identification of appropriate content and activities for students	4
		Practice with curriculum integration	2
		Dealing with enrollment and funding problems	2
		Experiencing science as a human enterprise	5
		Public awareness of real dimensions and importance of science	3
		Articulating a science continuum	2
		Classroom management and instructional strategies	2
		Laboratory skills, including laboratory safety and inquiry techniques	4
		Applying information from learning theorists	2
		Lack of coordination in education departments and K-12 schools	2
		More communication skills (human relations)	3
		Focus on future	1
		More cooperation with real world of teaching	1
		Dealing with special students	2
		Classroom management problems	1
Researchers	28	Lack of preparation with technological advances	1
		Preparation for shortages of planning time all elementary teachers are sure to experience	1
		Alleviating fear of teaching science	3
		Helping teachers find that the science they have studied is not the science appropriate for most	3

N = Number of Responses
F = Frequency of Responses

TABLE D 10.1 Tabulation of Open-Ended Responses Which List Other Major Problems with Teacher Education Programs (continued)

Group	N	Summary of Responses	F
Researchers continued		Teachers teach as they are taught; problems with science teaching exemplified by high school and college instructors	2
		Too little training for proficiency in use of science processes	2
		Lack of preparation in quantitative ideas	1
		Assistance with meeting individual student needs	1
		Assistance with designing curricula and instructional strategies	1
		Practice with integration with other curricula areas	2
		Optimal scope and sequence in science for K-6	1
		Appropriate science for prospective elementary teachers	2
		Experience with the real nature of science	3
		Making science useful to the lives of students	3
		Helping concrete thinkers (teachers) deal effectively with all learners	2

N = Number of Responses
F = Frequency of Responses

D 11. TEACHING K-12 SCIENCE AS INQUIRY SHOULD BE A MAJOR GOAL FOR THE 80's

TABLE D 11.1 Result of Respondent Ratings

		Elementary Teachers	**Secondary Teachers**	**Supervisors**	**Teacher Educators**	**Researchers**
Percentage	**agree**	88	85	84	75	57
	disagree	2	5	4	14	31
	neutral	10	10	12	11	12

GRAPH D 11.1 Graphic Presentation of Respondent Ratings

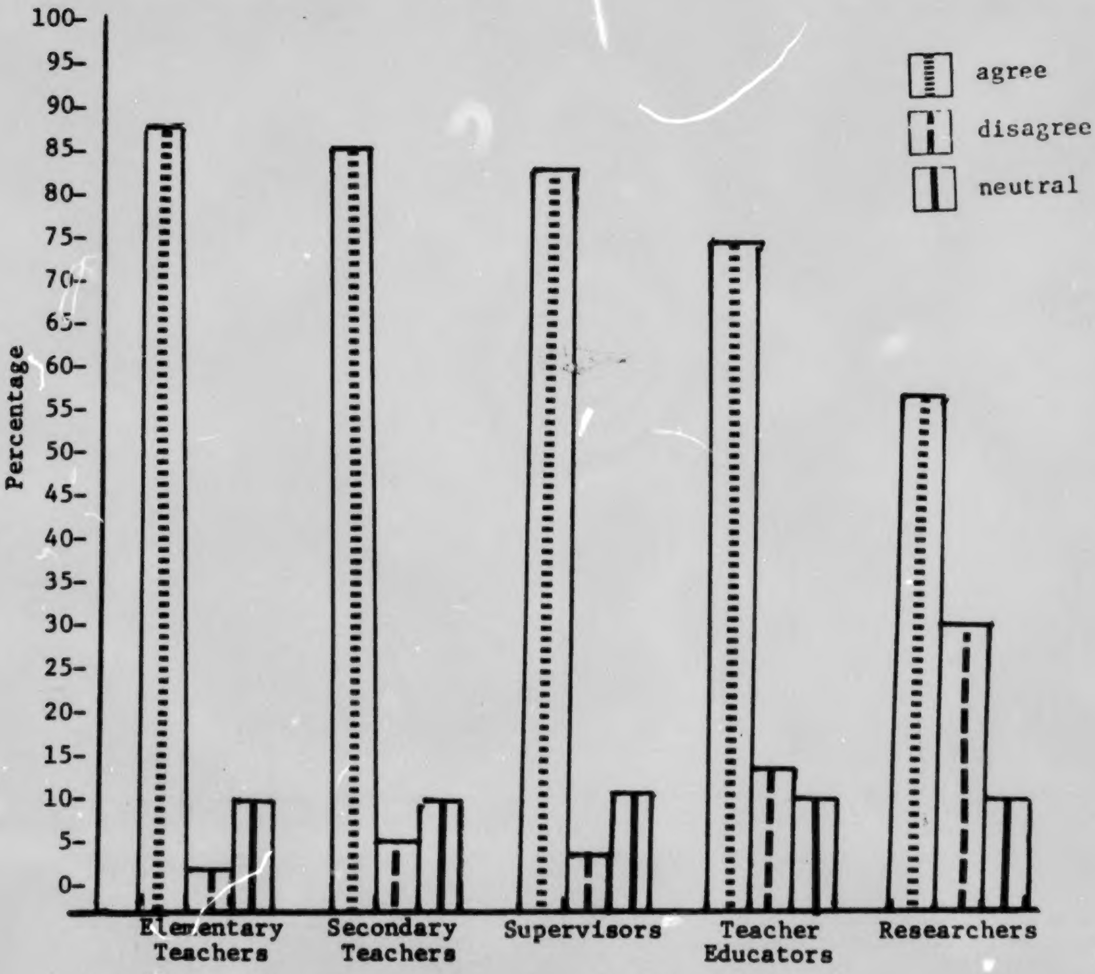
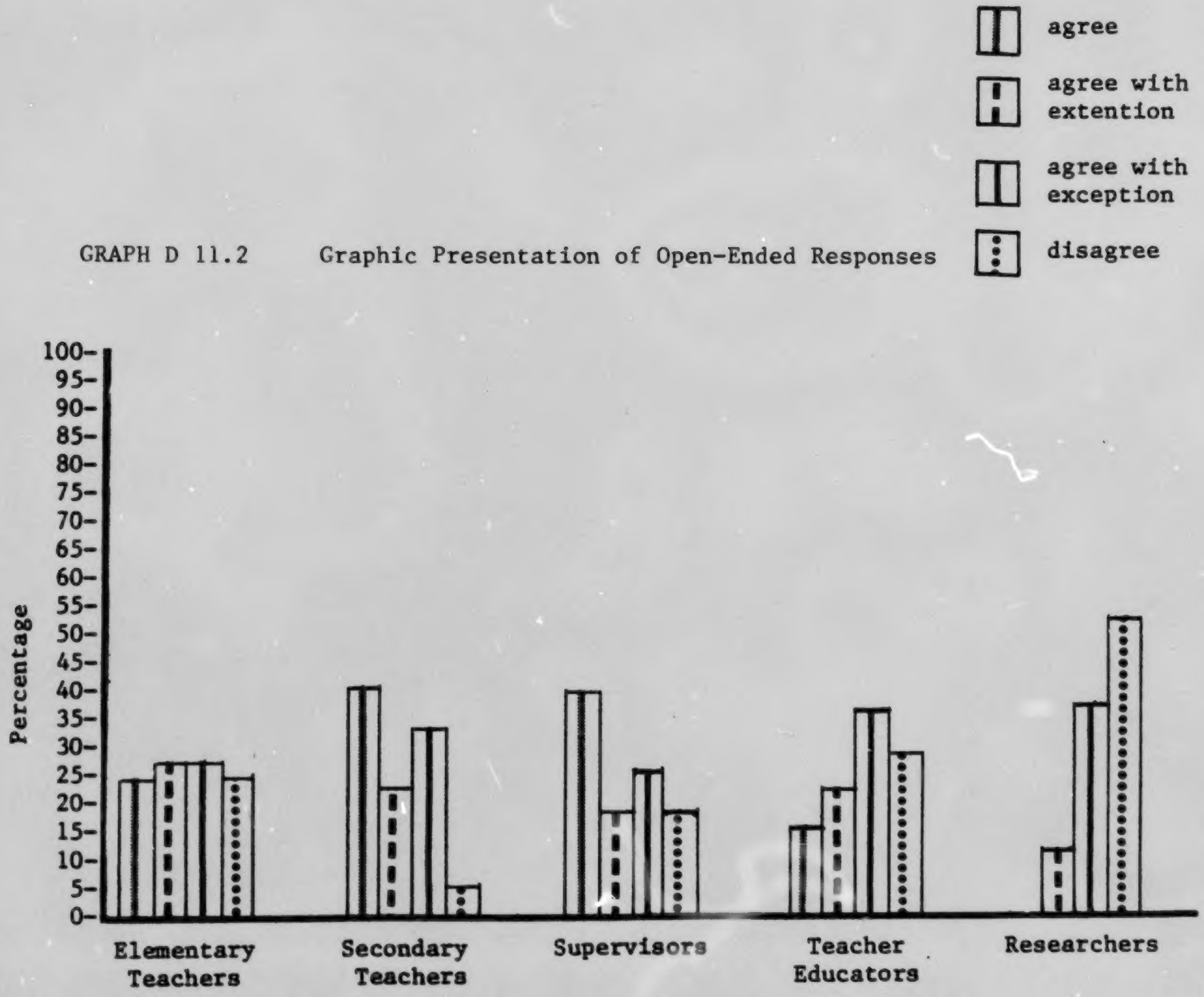


TABLE D 11.2 Categorization of Open-Ended Responses*

		Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
Percentage	agree	24	40	39	15	0
	agree with extention	26	22	18	22	12
	agree with exception	26	33	25	36	37
	disagree	24	5	18	27	51

GRAPH D 11.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(34) (58) (51) (45) (35)

TABLE D 11.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	9	Along with content and in-service training	3
		Especially important with hands on programs in elementary schools	5
		Follow up with research to do something in the community	1
Secondary Teachers	13	Teachers need more time for research and evaluation	3
		Teacher attitude fosters inquiry; laboratories and assignments help teach science	4
		Inquiry and problem solving are based on adequate foundation of vocabulary skills and basic concepts	6
Supervisors	9	Include university levels, especially for education majors	4
		Depends on level, e.g., K-6, yes; balance inquiry requires competent teacher	5
Teacher Educators	10	Strategies for teaching science as inquiry need to be incorporated into teaching program	3
		Will require more time to teach effectively; include world problems	4
		Operationally defined so there will be agreement on how to get there and when we have arrived	3
Researchers	4	A continuing need from the 60's	2
		Good for individual programs	2

N = Number of Respondents
F = Frequency of Responses

TABLE D 11.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	9	If content is not excluded	3
		Knowledgeable teacher is needed as well for feedback	2
		It may be meaningful, but not always practical	4
Secondary Teachers	19	Must have basic scientific knowledge to pursue inquiry properly	3
		Can frustrate and destroy interest of teacher; difficult to carry out	4
		Not always effective with non-science-oriented students	7
		With all the money and time invested in the last 15 years, we are still at the starting point	5
Supervisors	13	Time consuming, but a necessary skill for teachers to have	3
		Must include information in addition to what students discover	4
		Must also include basic skills	2
		Interaction of science and society is important as well	3
		Positive attitude must be major goal	1
Teacher Educators	16	Learning interesting and useful facts can be motivating	3
		Inquiry must pervade teaching or it will kill enthusiasm	3
		Need adequate conceptual base before inquiry has real meaning	3
		Not if it means watered-down science	4
		Need to be sure it includes understanding the structure of science and technology as they relate to society	3
Researchers	13	Different methods are required for different situations; inquiry techniques may not be best for all socio-economic groups	4
		Need to be sure expectations are realistic	2
		Does not work well in most classes	3
		Important for teacher to know what inquiry is, how it is taught, and how it differs from discovery	4

N = Number of Respondents
F = Frequency of Responses

TABEL D 11.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	8	Need to teach basic concepts first	3
		A subject is worthless if only approach is inquiry	2
		Some science cannot be taught this way	3
Secondary Teachers	3	Does not seem to be getting any place	3
Supervisors	9	Too abstract for many students, even at college level	3
		Inquiry may only help us re-invent the wheel	1
		Teacher and learning style may be incompatible	1
		Research shows this is a futile goal	3
		K-2 students may not be mentally mature enough for it to have meaning	1
Teacher Educators	12	Too many teachers are not able or qualified enough to use inquiry techniques	3
		Too much insistence that it be used is like insisting that everyone be a lecturer	1
		This word has been overused; has little or no meaning	5
		It has not worked in the past	3
Researchers	18	Not necessarily good for many learners	3
		Evidence to suggest it is inappropriate for most students	7
		Evidence that teachers do not use it	5
		This goal may have been cause of our past problems	3

N = Number of Respondents
F = Frequency of Responses

D 12. IMPROVEMENT OF TEACHING STRATEGIES IN SCIENCE SHOULD BE A MAJOR CONCERN FOR THE 80's

TABLE D 12.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	70	86	85	83	76
disagree	9	3	9	9	10
neutral	21	11	6	8	14

GRAPH D 12.1 Graphic Presentation of Respondent Ratings

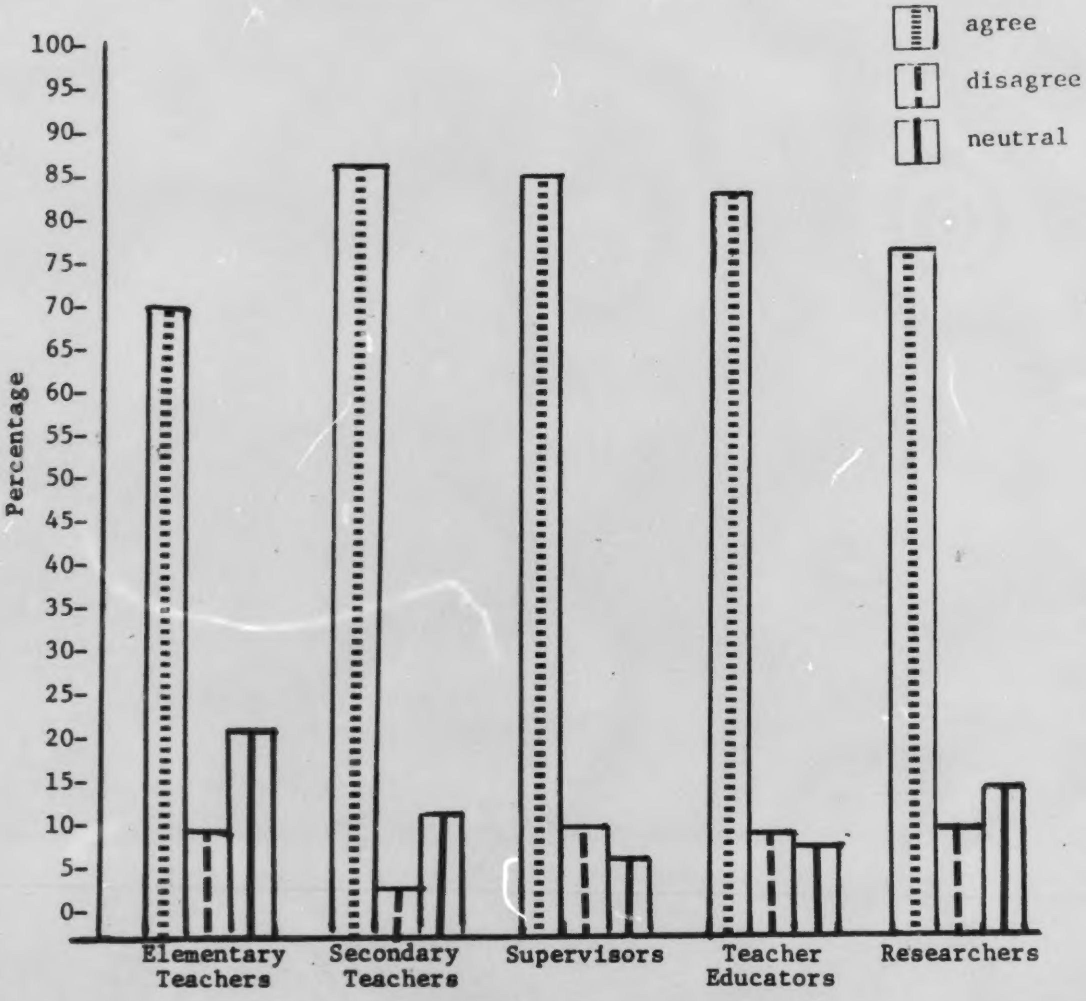
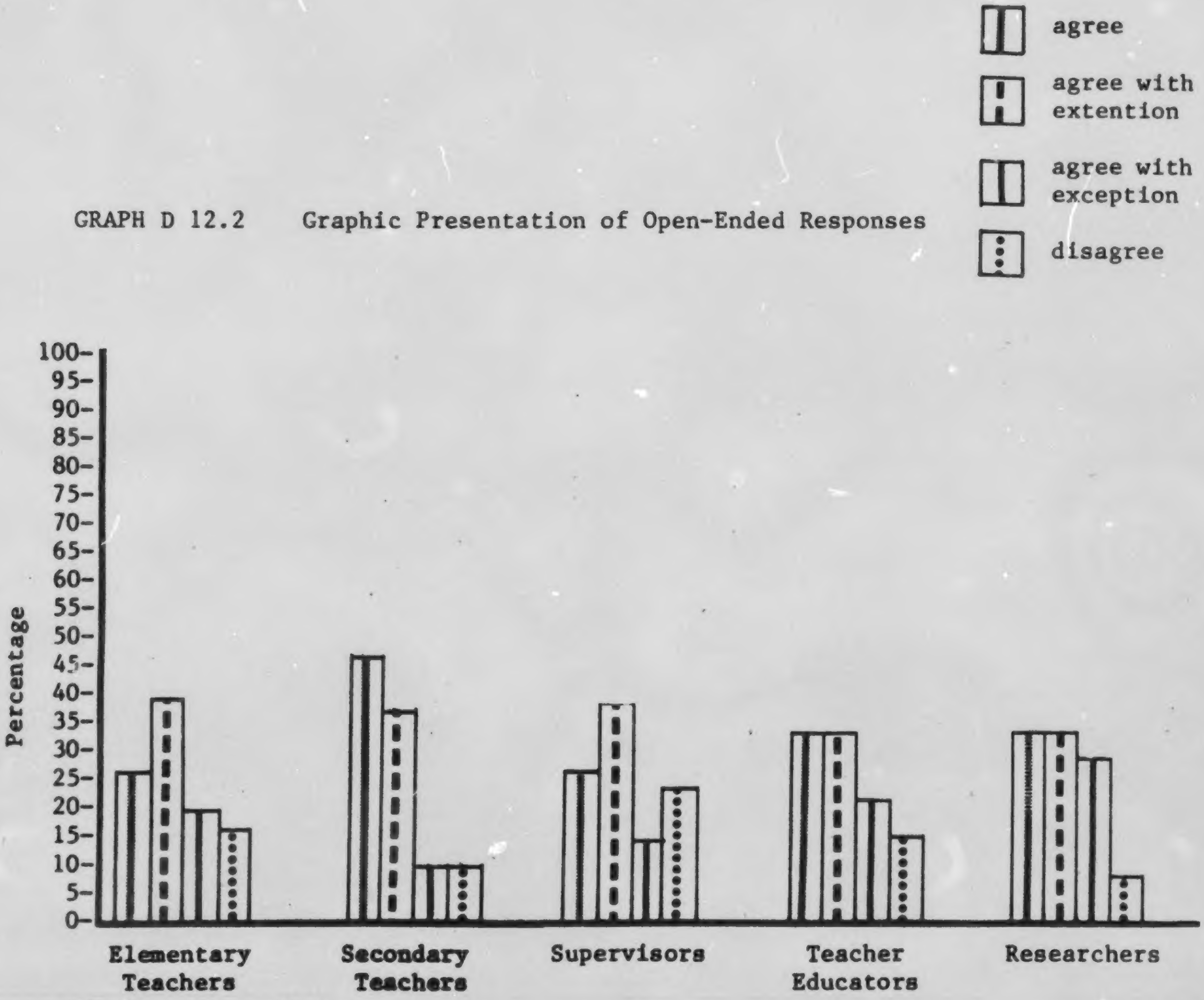


TABLE D 12.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	26	46	26	32	32
agree with extention	39	36	38	32	32
agree with exception	19	9	13	21	28
disagree	16	9	23	15	8

GRAPH D 12.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(31) (33) (39) (38) (25)

TABLE D 12.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	12	New programs moving us in that direction	3
		Need to have a lot of "hands on" experience	3
		Improve what is true; delete what is not	2
		Continue research; variety is needed to meet student diversity	4
Secondary Teachers	12	New strategies increase teacher and student zest	3
		Must consolidate and improve ideas using Piaget, Karplus, etc.	3
		Interdisciplinary and use computers are examples	2
		Better community relations between school and industry	4
Supervisors	15	U.S. can learn from Japanese teacher training facilities!	2
		Need individual instruction, self-paced instruction, increased motivation	3
		More variety needed	3
		Need improved evaluation of programs	3
		Match students better with programs and strategies	4
Teacher Educators	12	Strategies to teach society-related science, especially elementary education programs	3
		Strategies exist must teach teachers; use strategies from other disciplines; implement them	5
		Use science as a vehicle to develop general competencies and goals of education	2
		Need concern for anti-science attitudes	2
Researchers	8	Heading toward extended pre-service that gives preparation, motivating opportunities	3
		Redirection more than improvement, new strategies	2
		Need better quality of instruction	3

210

N = Number of Respondents

F = Frequency of Responses

TABLE D 12.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	6	Get teachers to use strategies; need better inservice to use them correctly	2
		Need to develop good science attitudes as well as teaching techniques	
Secondary Teachers	3	Must know which strategies more powerful and why	3
Supervisors	5	Diverse backgrounds and smaller budgets mean laboratory work must take place without proper laboratories	2
		First need to "de-science" many teachers	3
Teacher Educators	8	Not more methods, need to learn how to encourage students	3
		Retain vitality, put new things to work	2
		Need to involve other skill areas, i.e., math, reading, P.E. as well	3
Researchers	7	Strategies must be based on theory	2
		Strategies are important, but need alternatives as models	3
		Concern is there, but must get to work	2

N = Number of Respondents
F = Frequency of Responses

TABLE D 12.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	5	Teach basic inquiry approach; reinforce what we have	3
		Do not lose ground	2
Secondary Teachers	3	School and society reject such major concerns for new teaching strategies	2
		Gear inquiry to cognitive level of students	1
Supervisors	9	We have the strategies; get them implemented	5
		Teacher attitudes should be a major concern and lack of students	4
Teacher Educators	6	Do what we do better and more often	2
		Enough strategies, must teach teachers what we already know about effective teaching	2
		Change way we approach strategies	2
Researchers	2	Need to implement existing ones	2

N = Number of Respondents
F = Frequency of Responses

D 13. ATTENTION TO BUDGETS, INCLUDING THAT FOR EQUIPMENT AND SUPPLIES, SHOULD BE A MAJOR CONCERN FOR THE 80's

TABLE D 13.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	84	90	93	76	70
disagree	2	0	3	17	10
neutral	14	10	4	7	20

GRAPH D 13.1 Graphic Presentation of Respondent Ratings

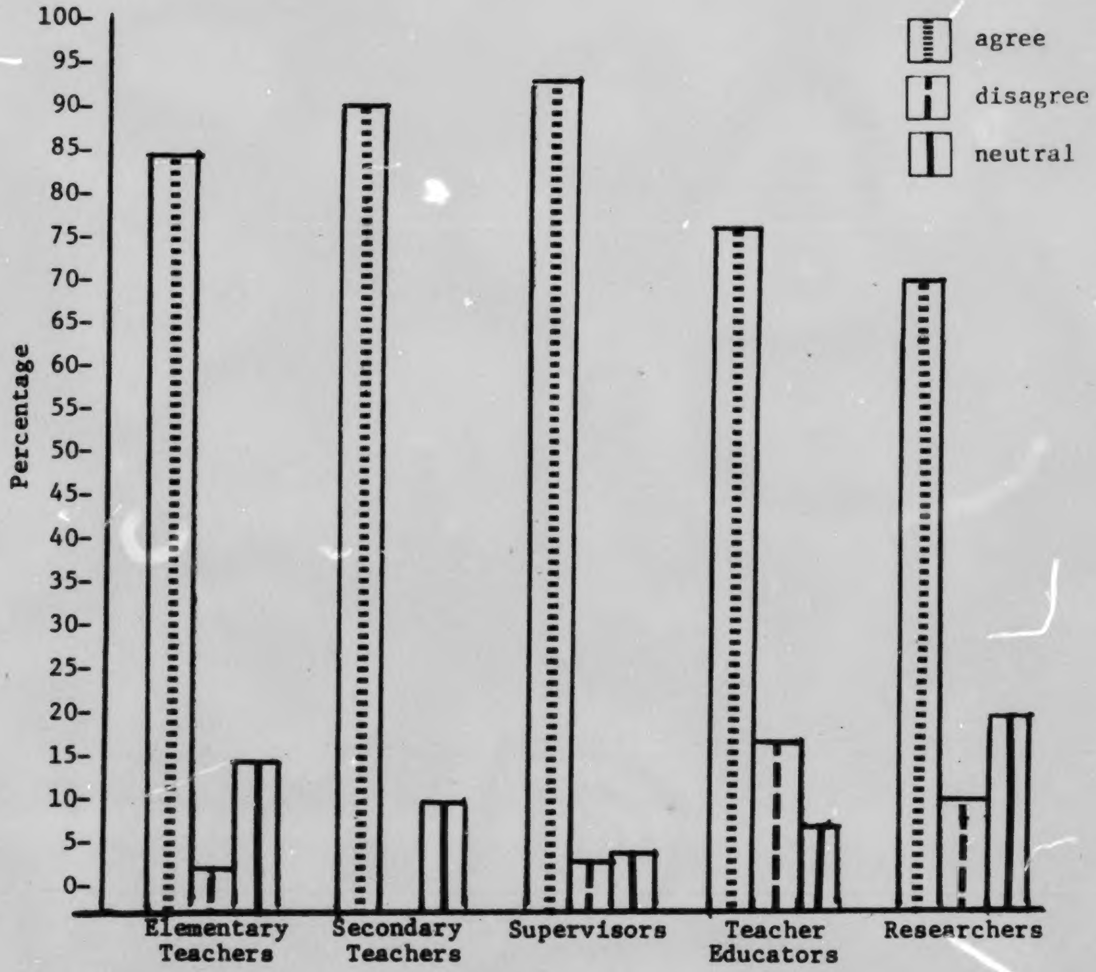
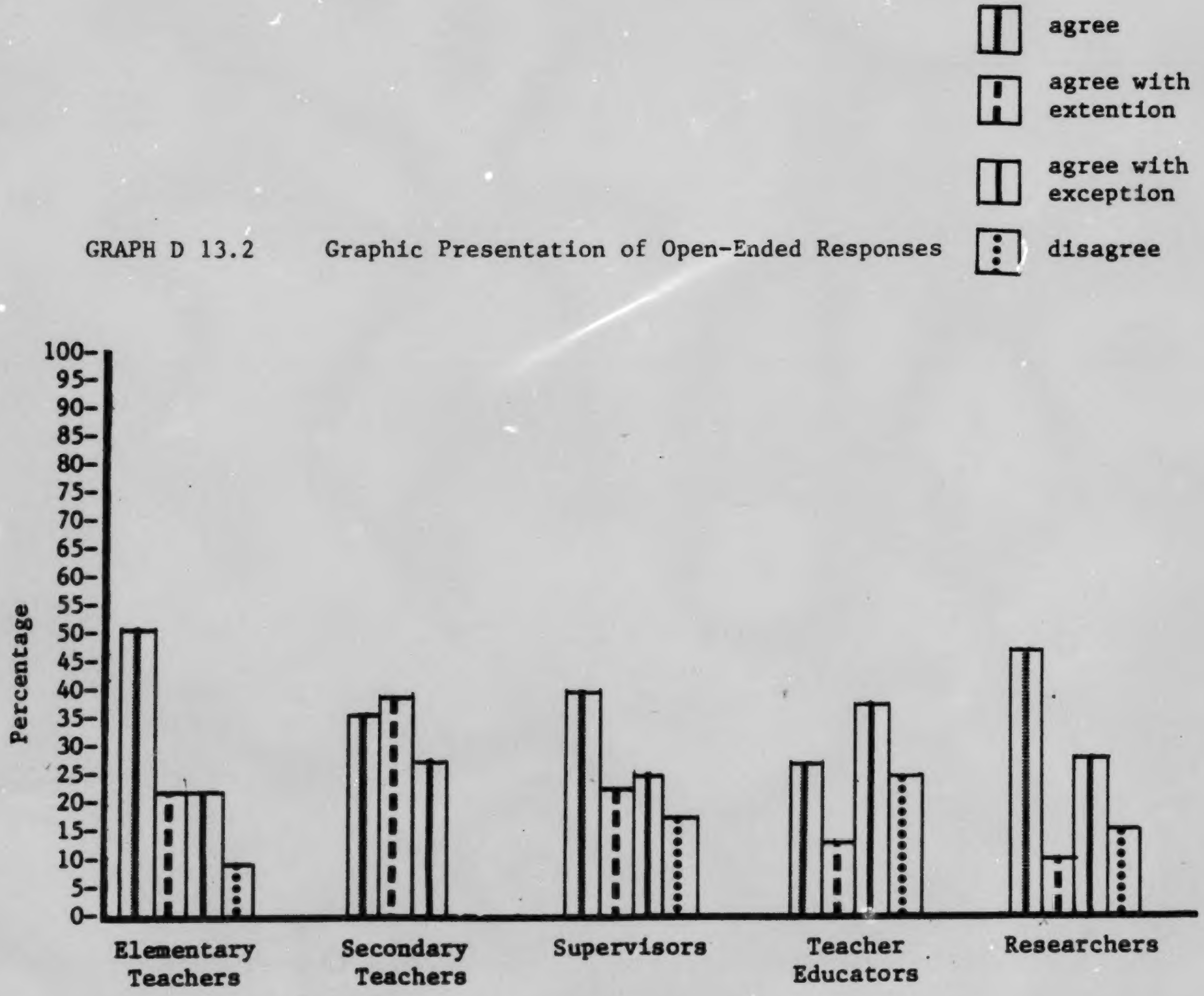


TABLE D 13.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	50	35	39	26	47
agree with extention	21	38	21	13	10
agree with exception	21	27	23	37	28
disagree	8	0	17	24	15

GRAPH D 13.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(34) (48) (52) (46) (47)

TABLE D 13.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	7	Learning centers help	3
		Community resources can be used better	4
Secondary Teachers	18	Inflation is a major factor	6
		Science centers may help	3
		More suggestions for substitutes and alternative approaches needed	4
		Need cooperatives--sharing	5
Supervisors	11	Inflation real problem	3
		Need to include program of evaluation	4
		Need help in planning, preservice and inservice	4
Teacher Educators	6	This is biggest factor in abandonment of newer programs	4
		Need community involvement	2
Researchers	5	Need teachers who see value in activities	2
		Cost sharing plans	3

N = Number of Respondents
F = Frequency of Responses

TABLE D 13.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	7	Teacher attitude more important	3
		Much waste currently	4
Secondary Teachers	13	Need curriculum suggestions that do not rely on materials	3
		Need more concern for goals	3
		Class size and curriculum are more important	2
		Teacher attitude is more important	3
		Better use of existing materials more important	2
Supervisors	12	Other factors more important	5
		Experience of 60's and 70's bad	5
		Really people problems	2
Teacher Educators	17	Teachers do not use materials they have to best advantage	4
		Real needs do not cost money	3
		This is often used merely as crutch	4
		There are funds to get what people value	3
		Maintenance of materials often neglected	3
Researchers	13	Supplies can be misused, wasted as well	3
		Teacher philsophy most important	5
		Need less costly laboratories	5

216

N = Number of Respondents
F = Frequency of Responses

TABLE D 13.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	3	Need help in using what already in classrooms	1
		Cannot use well what already have	2
Secondary Teachers	0		
Supervisors	9	Teacher attitude (philosophy) is more important	4
		Use of community and real world is not costly and does not require special materials	5
Teacher Educators	11	Equipment and budget simply not causes	4
		Funds for people more important	4
		Improving classroom practices is more important	3
Researchers	7	Research suggests little or no real influence on quality	3
		Other concerns are greater	2
		Budget cuts often suggest the real problem	2

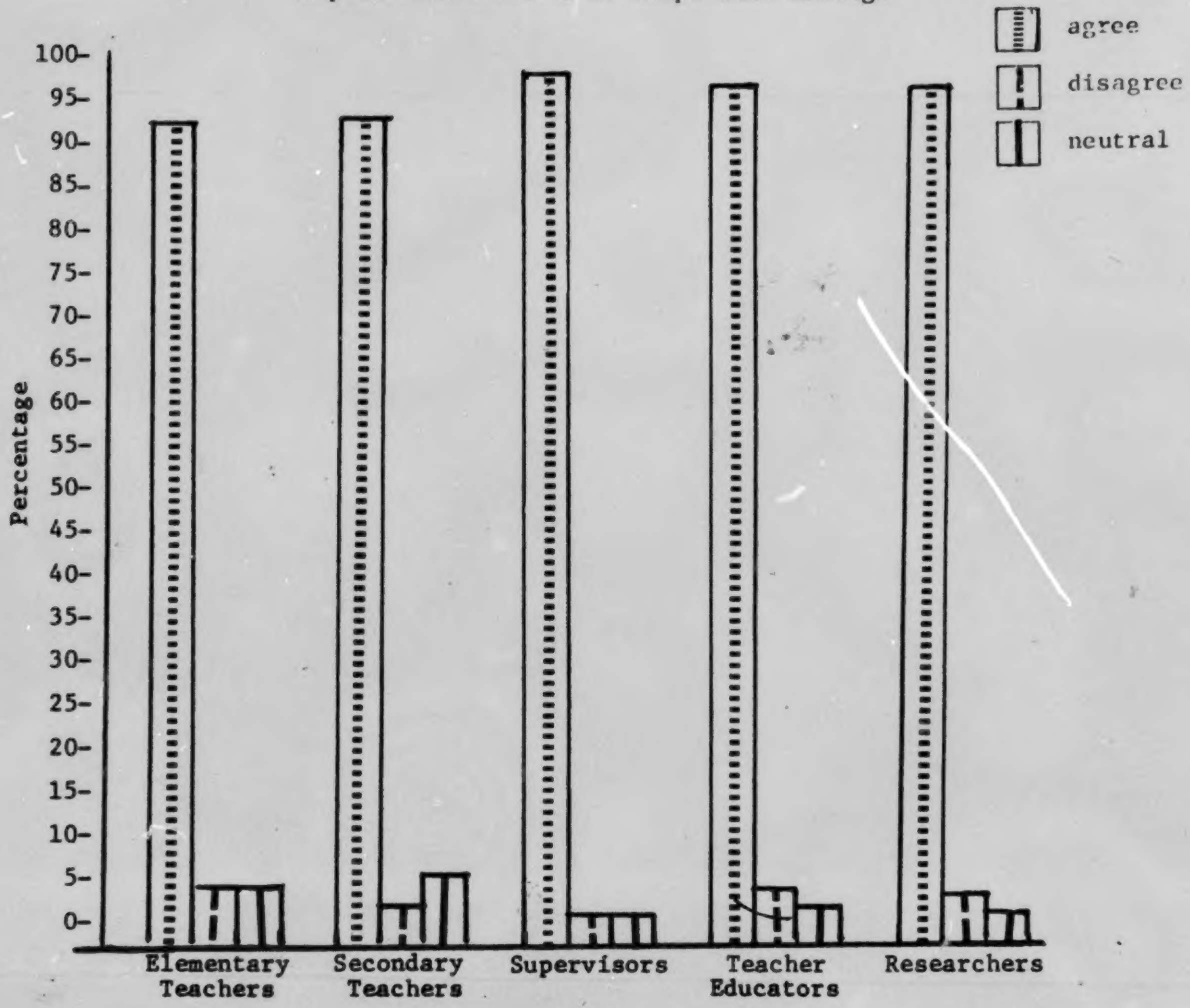
N = Number of Respondents
F = Frequency of Responses

D 14. RENEWED ATTENTION TO IN-SERVICE TEACHER EDUCATION SHOULD BE A MAJOR PRIORITY IN THE 80's

TABLE D 14.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	92	93	97	96	96
disagree	4	2	1.5	3	3
neutral	4	5	1.5	1	1

GRAPH D 14.1 Graphic Presentation of Respondent Ratings

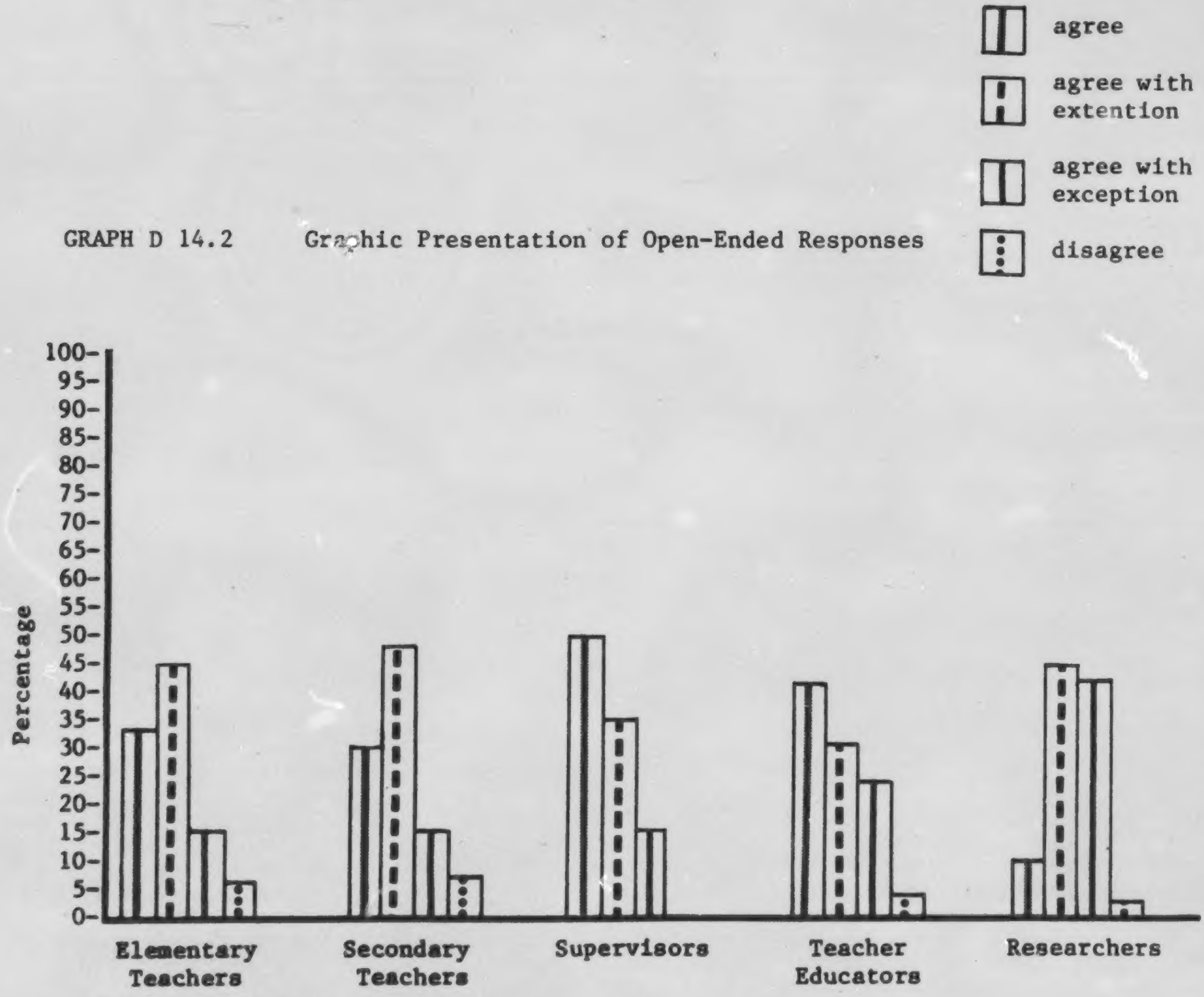


218

TABLE D 14.2 Categorization of Open-Ended Responses*

		Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
	agree	33	30	50	42	10
Percentage	agree with extention	46	48	35	31	45
	agree with exception	15	15	15	23	41
	disagree	6	7	0	4	4

GRAPH D 14.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(33)	(46)	(46)	(57)	(29)

TABLE D 14.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	15	Need for growth is continuous	5
		Need to be more philosophical	2
		Need to be more future oriented	4
		Too often subject matter oriented	2
		Need to be well planned - paid of system	2
Secondary Teachers	22	New teaching technology demands it	5
		Needs to be continuous	3
		Needs to involve more people cooperatively	5
		Need NSF institutes more than ever before	5
		Less teacher turnover, so more in-service needed	4
Supervisors	16	Need supervisors prepared to help	3
		Bigger problem now because of fewer young teachers	5
		In-service should be part of daily schedule of every professional	4
		Need to know more about teachers	4
Teacher Educators	18	Particularly important when goals change	3
		Stability of teacher force makes even more important	7
		A profession like teaching is always changing (or should be)	4
		Needs to be a force for getting elements of the professional together	4
Researchers	13	Evaluation should be basic to plan	3
		Need to work with teachers - not work at them	4
		Needs to be continuous (not hit and run)	6

N = Number of Responses
F = Frequency of Responses

220

TABLE D 14.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	5	Time is a problem	3
		Be sure they are designed to help with specifics	2
Secondary Teachers	7	Need to know difference between fact and pet philosophy	3
		Need to work on philosophy too	4
Supervisors	7	Pre-service programs contribute to this need	3
		Ones with greatest need will be last to participate	4
Teacher Educators	13	Many of the current ones are ineffective	4
		Context and philosophy more important than content and their existence	5
		Need a local commitment	5
Researchers	12	Many mistakes made in 60's and 70's	3
		Need to improve pre-service programs as well	4
		Teachers need to perceive need first	5

N = Number of Responses
F = Frequency of Responses

TABLE D 14.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	2	Most are "much ado about nothing"	2
Secondary Teachers	3	NSF support during 60's and 70's suggest in-service is a waste	2
		NSTA does little to suggest the importance in this area	1
Supervisors	0		
Teacher Educators	2	Enough already set aside for in-service	2
Researchers	1	Too much emphasis on teacher self help improved conditions	1

N = Number of Respondents
F = Frequency of Responses

D 15. ATTENTION TO THE EMPLOYMENT OF ADDITIONAL CONSULTANTS AND OTHER SUPPORT STAFF SHOULD BE A MAJOR PRIORITY OF THE 80's

TABLE D 15.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	78	60	89	74	74
disagree	9	17	5	7	11
neutral	13	23	6	19	15

GRAPH D 15.1 Graphic Presentation of Respondent Ratings

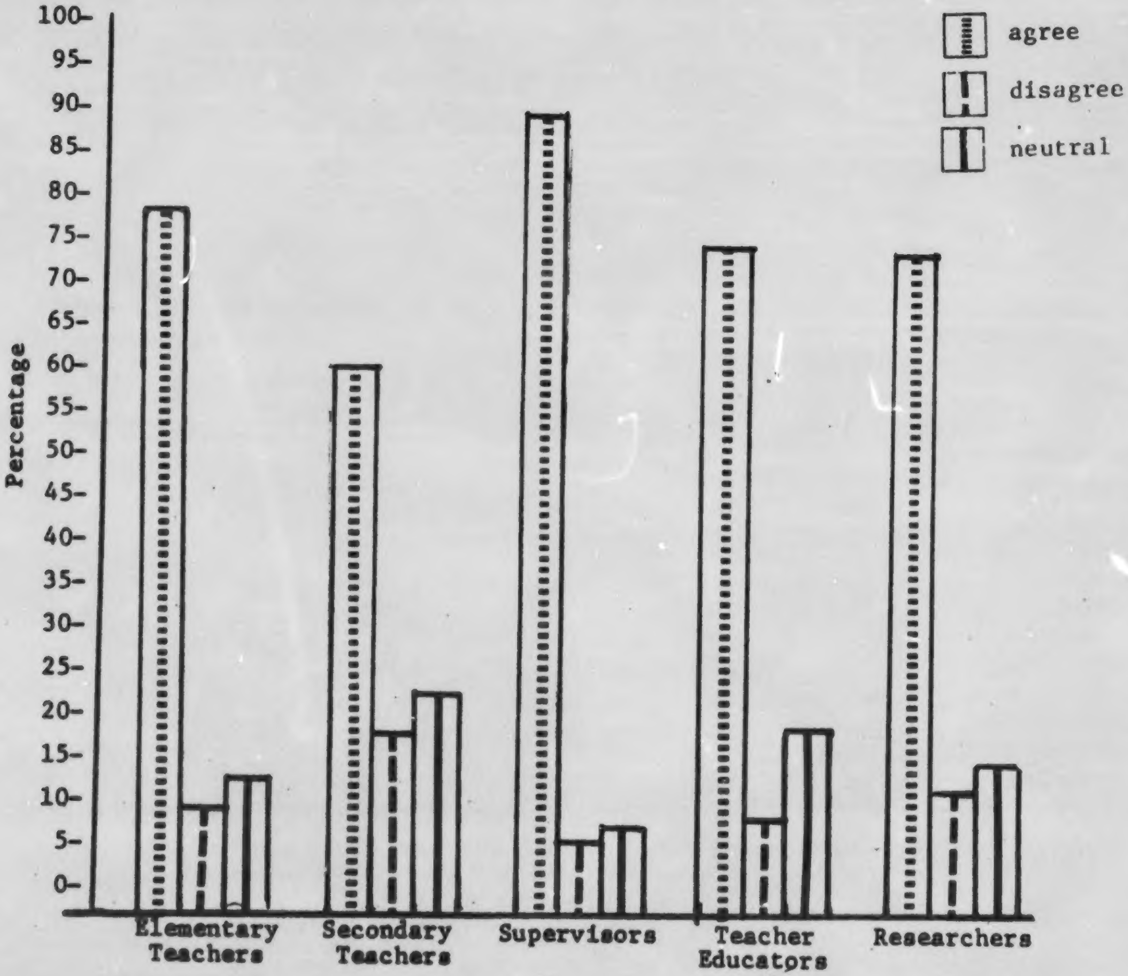
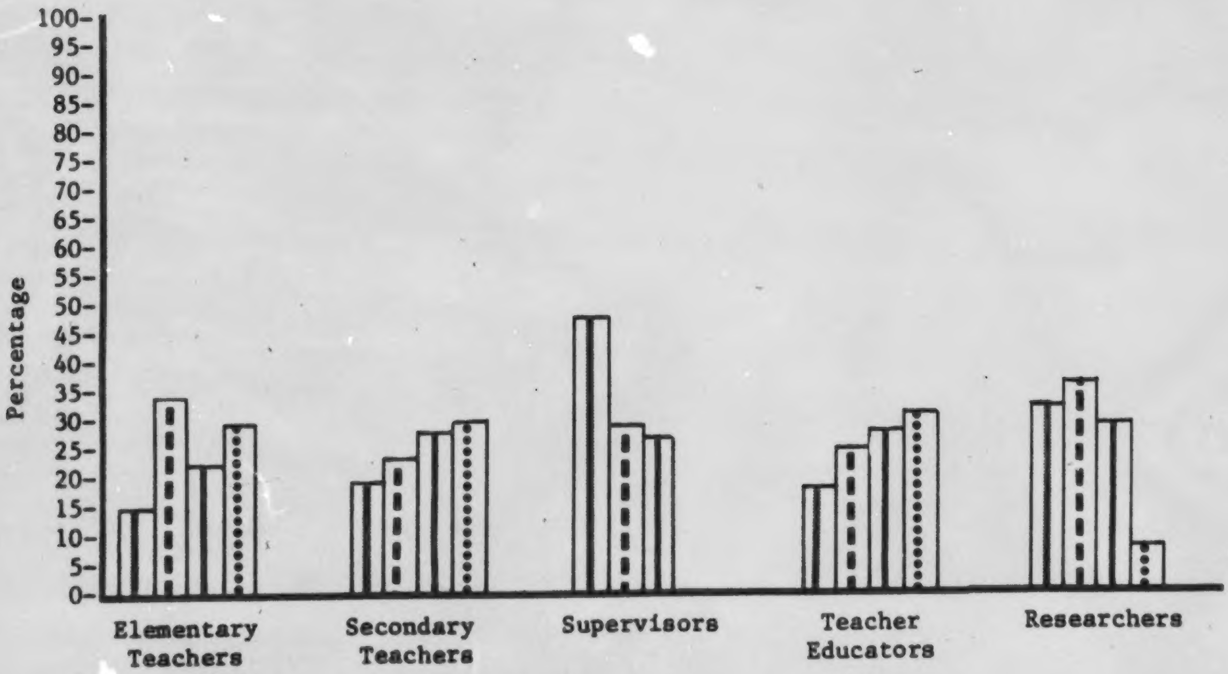


TABLE D 15.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	15	19	46	18	31
agree with extention	34	23	28	24	35
agree with exception	22	28	26	27	28
disagree	29	30	0	31	6

GRAPH D 15.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
(41)	(47)	(43)	(45)	(32)

TABLE D 15.3 Tabulation of Open-Ended Responses Which Extend Position

Group	N	Summary of Responses	F
Elementary Teachers	14	Such persons provide needed coordination	4
		Good for program at elementary level - less important in secondary schools	3
		Need to be sure they support curriculum and instruction	4
		Need to be a master teacher themselves	3
Secondary Teachers	11	Good for communication and public relations	3
		Do promote articulation	3
		Help define curriculum in ways other than courses	2
		Good to bring new ideas to local attention	3
Supervisors	12	Need a strong advocate	3
		Must have persons to help with supplies, changes, professional growth	4
		This staff handles bulk of regular in-service	3
		Especially valuable for elementary science program	2
Teacher Educators	11	Helps new teachers especially	2
		Need to encourage professional cooperation generally	4
		Especially important at elementary level	2
		Can help encourage teachers; assist with their sources	3
Researchers	11	Especially important for elementary level	2
		Important with activity approaches	3
		Such staff help raise expectations	2
		More chance for teacher communication and even cross-discipline work	4

N = Number of Respondents
F = Frequency of Responses

TABLE D 15.4 **Tabulation of Open-Ended Responses Which Take Exception to the Position**

Group	N	Summary of Responses	F
Elementary Teachers	9	Local only is needed	2
		Often teachers don't utilize their services	3
		Funding is problem	4
Secondary Teachers	13	Impact is often negligible	2
		Too many are political appointees	4
		Often such people have no special training	4
		They often create busy-work	3
Supervisors	11	Need to define roles - some are consultants by name only	3
		Need to be sure they remain "helpers"	2
		Must be "action" people	4
		Quality must be major factor	2
Teacher Educators	12	Too many are not on cutting edge	2
		Too often they get too many extra duties assigned	3
		They need to "minister" not "manage"	3
		Other kind of support staff may be more important	4
Researchers	9	Takes "special" person for such positions	4
		May be unrealistic in terms of current economy	3
		Need to define positions carefully	2

N = Number of Respondents
F = Frequency of Responses

TABLE D 15.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	12	Many are just "other" administrators	3
		Too many strain tight budgets ever more	2
		Too many can't head meaningful in-service	4
		Need more good teachers, fewer supervisors	3
Secondary Teachers	14	Too costly	4
		Do not really help	3
		Worst teachers "elevated" to such positions	3
		Most increase paper work and senseless meetings	4
Supervisors	0		
Teacher Educators	14	Too often these persons are ineffective	6
		Too many are administrators - not helpers	2
		No research to suggest value	2
		Too costly - more important needs	4
Researchers	2	More need to work on motivating individual teachers	1
		More is not necessarily better	

N = Number of Respondents
F = Frequency of Responses

D 16. SCHOOLS AND SCHOOL PERSONNEL SHOULD BE INVOLVED TO A GREATER DEGREE IN PRE-SERVICE EDUCATION

TABLE D 16.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	90	79	84	82	84
disagree	1	5	8	8	10
neutral	9	16	8	10	6

GRAPH D 16.1 Graphic Presentation of Respondent Ratings

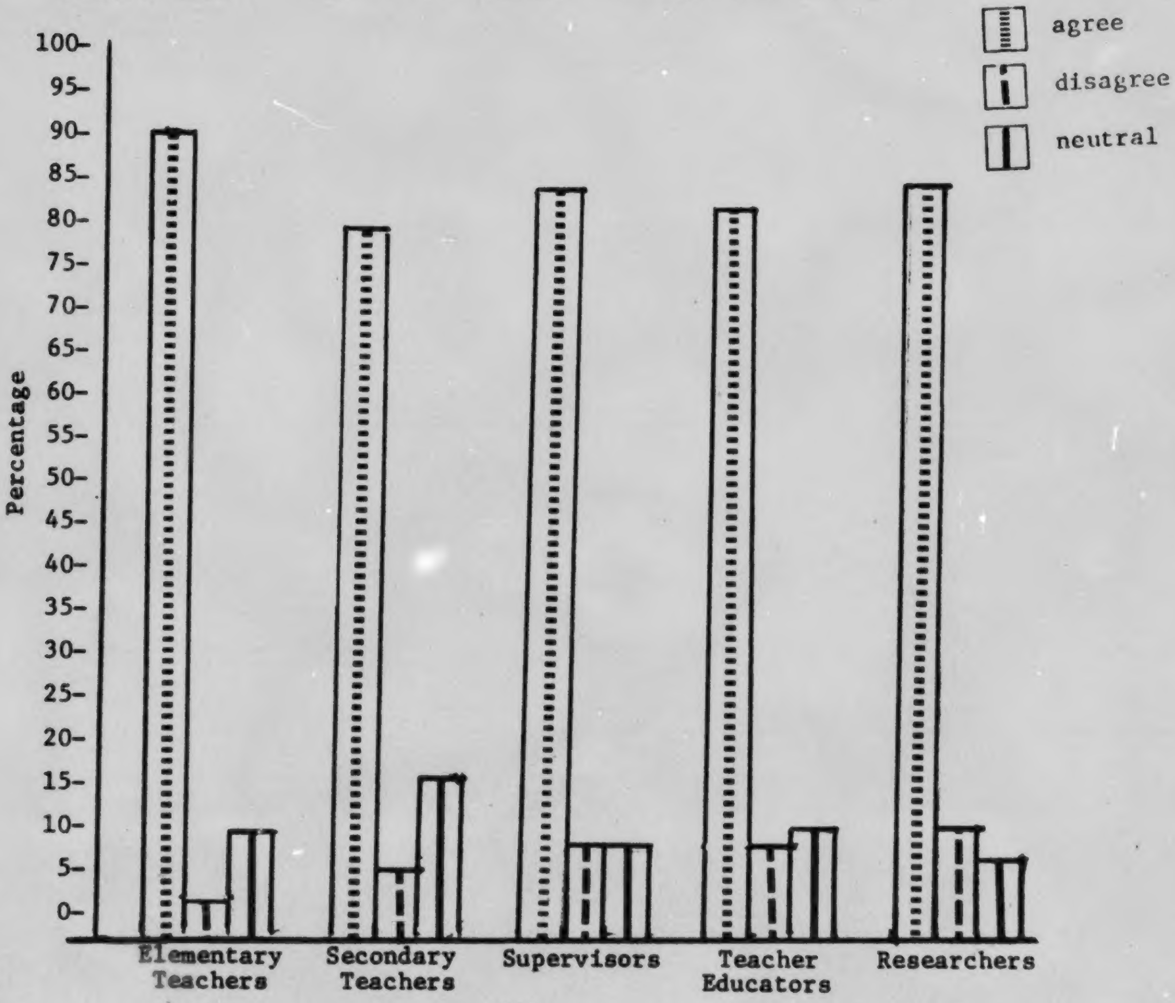
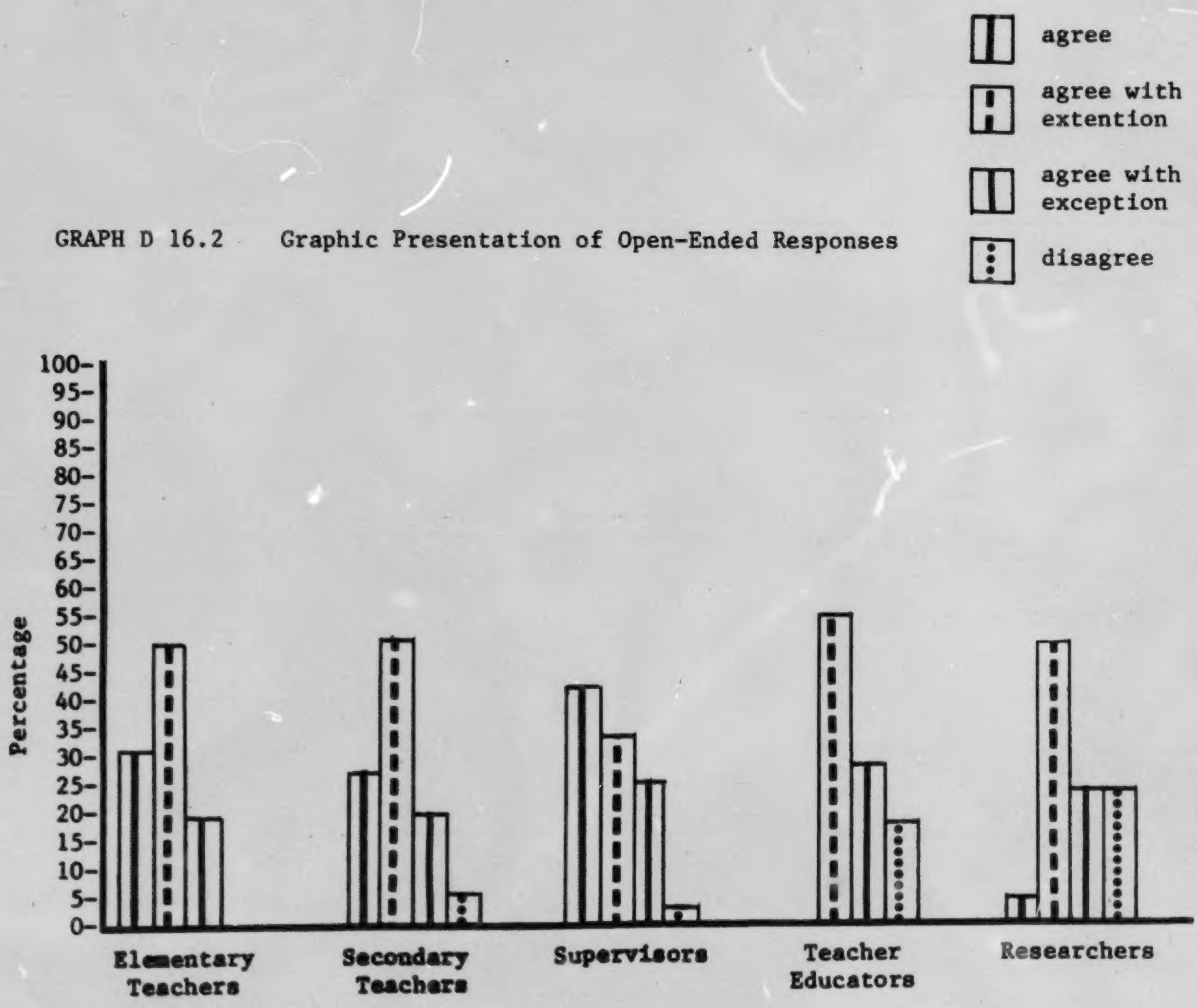


TABLE D 16.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	31	26	41	0	4
agree with extention	50	50	33	55	50
agree with exception	19	19	24	27	23
disagree	0	5	2	18	23

GRAPH D 16.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(26) (38) (42) (44) (22)

TABLE D 16.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	13	Need information on new school science programs while in college	3
		Need to let college staff act as teachers and/or support personnel	6
		Need continuing experience with research, with live students, with various professionals	4
Secondary Teachers	19	Pre-service staff and programs need help	8
		Need all help possible for professional improvement	2
		In-service teachers should help plan research and pre-service courses	4
		Too many college people do not know schools and students	3
		Need more communication within levels and across levels	2
Supervisors	14	Should also include all professional levels in schools	1
		Good to have model teacher as full-fledged college staff member	2
		Teacher education staff should be links in professional chain	2
		Need more cooperative atmosphere	5
		Need to bring theory and practice closer together	4
Teacher Educators	24	Teachers need help with research/evaluation	3
		All too few models to point to	2
		Certification rules need changes	3
		Teacher educators could get more real world experience	4
		Profession needs more cooperation	8
		Numerous field experiences are musts	4
Researchers	11	Workshops are an important component	2
		Theory and practice must influence each other	2
		Effective teachers must have early and continuing interaction with students	4
		Cooperative teachers are known as major force	3

N = Number of Respondents
F = Frequency of Responses

TABLE D 16.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	5	"Improved" better than "increased"	1
		Should be true for education in general	2
		Need to define involvement	2
Secondary Teachers	7	Individual turfs are hard to soften	2
		School involvement may only preserve status quo	2
		Colleges do little nowadays to prepare new teachers for real world	3
Supervisors	10	Can get too theoretical - too superficial	3
		Too many turfs pervade the profession	3
		May be too idealistic	2
		Schools maybe should not be involved with teacher education	2
Teacher Educators	12	Too much research is worthless	3
		As long as decisions rest with universitites	2
		There is a question of finances	3
		Schools and teachers must see the values to them	4
Researchers	5	Some programs have gone overboard	2
		It must be a two-way street	3

N = Number of Respondents
F = Frequency of Responses

TABLE D 16.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	0		
Secondary Teachers	2	Communication, research, and teacher education are continuing processes, not major needs	2
Supervisors	1	Not a major need	1
Teacher Educators	8	Teacher educators are already involved significantly in schools	2
		Too much is know how	3
		Teacher educators know the real world without more school involvement	3
Researchers	5	Practitioners cannot be responsible for "professional" preparation	2
		Nature of "involvement" needs clarification	3

N = Number of Respondents
F = Frequency of Responses

D 17. COMPETENCY-BASED TEACHER EDUCATION PROGRAMS SHOULD BE ENCOURAGED BECAUSE OF THEIR CURRENT IMPORTANCE AND IMPACT

TABLE D 17.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	63	60	48	35	30
disagree	10	8	14	43	51
neutral	27	32	38	22	19

GRAPH D 17.1 Graphic Presentation of Respondent Ratings

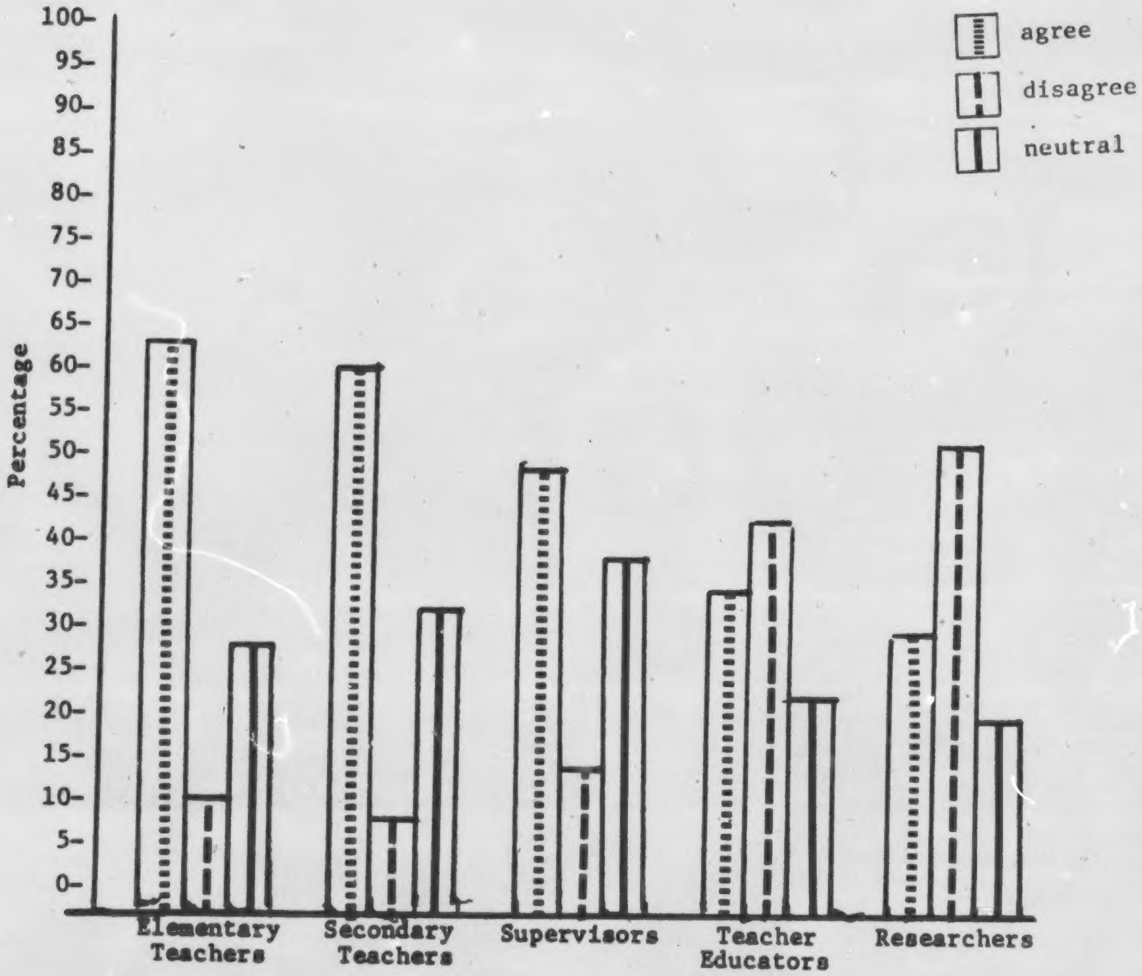


TABLE D 17.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	3	8	10	4	9
agree with extention	30	37	10	11	9
agree with exception	35	18	28	18	23
disagree	32	37	52	67	59

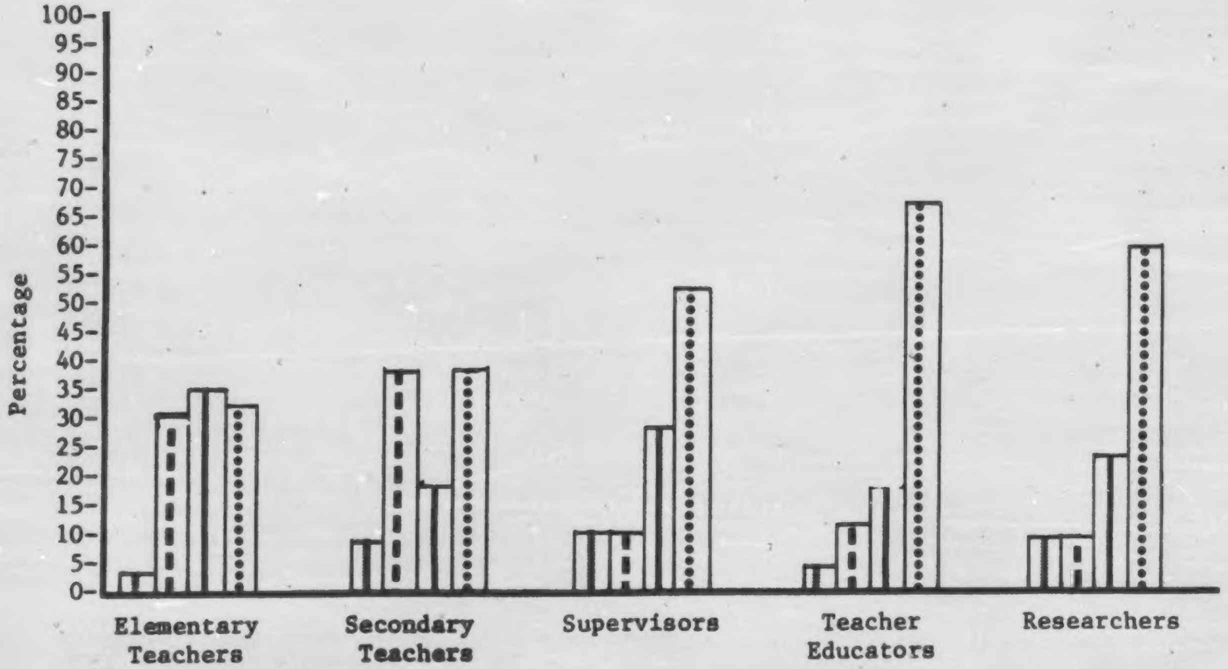
▯ agree

▯ agree with extention

▯ agree with exception

⁝ disagree

GRAPH D 17.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(34) (38) (42) (45) (47)

TABLE D 17.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	10	Good guides for pre-service	3
		Help establish criteria for those desiring to improve	2
		Good to review what makes a competent teacher	3
		It helps define "science background"	2
Secondary Teachers	14	Good way of defining 'good' teaching	3
		Helps define goals	2
		Helps get rid of "dead wood" in profession	5
		Competency is base for any professions	4
Supervisors	4	Means more professional involvement and cooperation	3
		Good to think about standards	1
Teacher Educators	5	Teachers need to assume responsibility for their actions	2
		Competency is a desirable teacher and student goal	3
Researchers	4	Satisfactory to define skills, knowledge, and attitudes	2
		Stimulates persons to think about evaluation	2

N = Number of Responses
F = Frequency of Responses

TABLE D 17.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	12	Need to identify problems	3
		Provides progress with assessment of 'good' teaching	4
		Hard to define adequately	3
		Know too little about it	2
Secondary Teachers	7	May be like behavioral objectives	2
		Seems like a religion for some	3
		Difficult to measure important features	2
Supervisors	12	Schools must have input	2
		Need more careful study	4
		So far competencies are mundane	3
		Opens whole area of certification	3
Teacher Educators	8	Difficult to use in developing a program	2
		It is dehumanizing	4
		Need to work on better tools for evaluation	2
Researchers	11	Next to impossible to operationalize behavior patterns	2
		A profession is more than a set of competencies	3
		Impact may be negative	6

N = Number of Respondents
F = Frequency of Responses

TABLE D 17.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	11	It is a fad	3
		No evidence of value	5
		Seems to be declining in importance	3
Secondary Teachers	14	No evidence of value	5
		Movement is on decline	5
		Too many are against it	4
Supervisors	22	Movement on a decline	10
		College invention	2
		Concept is ludicrous	5
		Encourages minimal standards	5
Teacher Educators	30	No evidence of its value	19
		Movement is in decline	11
Researchers	28	Narrows curriculum; a false view of the profession	6
		It is a "past" phenomenon	12
		It misses the point of science, especially self-correcting features	3
		No evidence of its value or importance	7

N = Number of Respondents
F = Frequency of Responses

237

D 18. GREATER COMMUNITY INVOLVEMENT IN SCIENCE CURRICULUM, TEACHING, AND DIRECT STUDENT EXPERIENCES SHOULD BE ENCOURAGED

TABLE D 18.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	84	65	69	70	71
disagree	8	13	13	14	14
neutral	8	22	18	16	15

GRAPH D 18.1 Graphic Presentation of Respondent Ratings

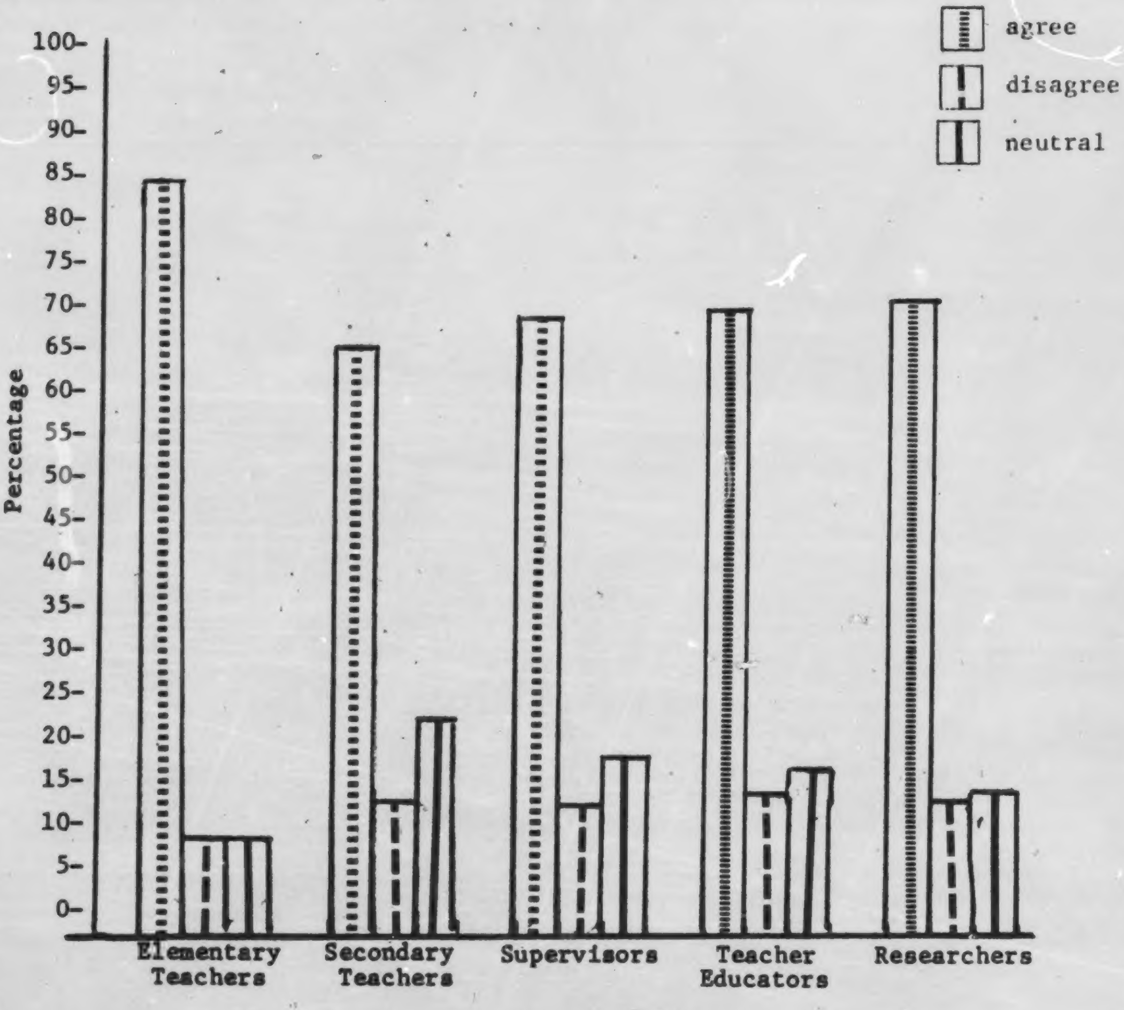
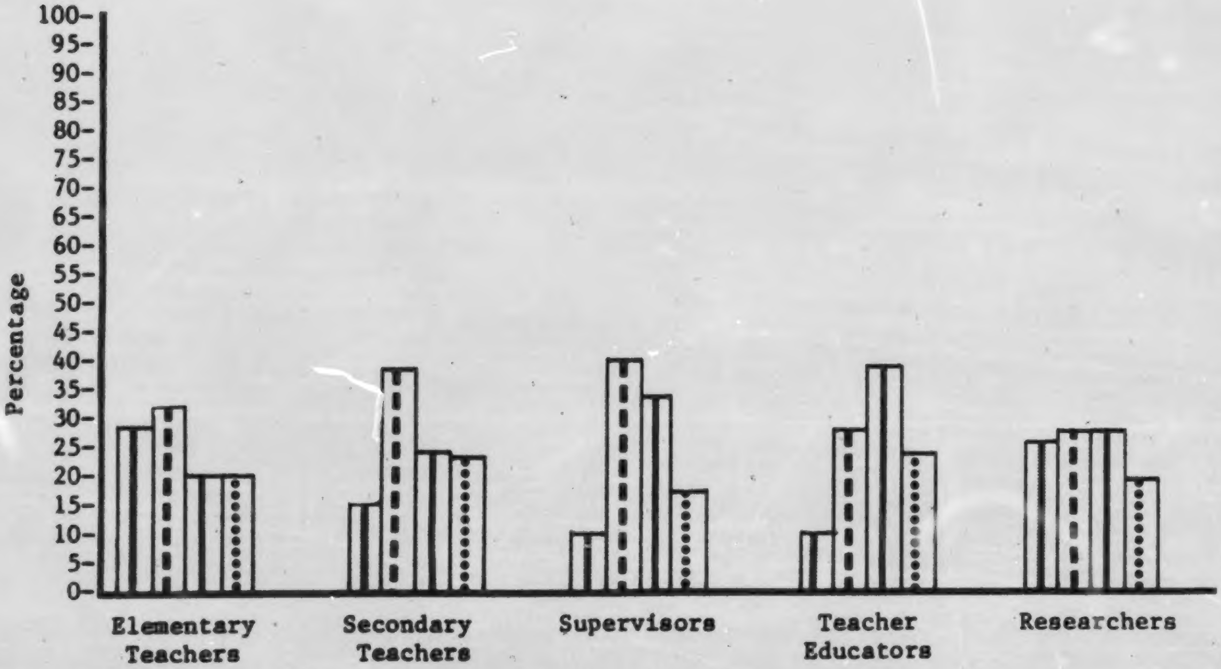


TABLE D 18.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	28	15	10	10	25
agree with extention	32	38	40	27	28
agree with exception	20	24	33	39	28
disagree	20	23	17	24	19

GRAPH D 18.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
(34)	(61)	(48)	(41)	(32)

TABLE D 18.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	11	Work through goals	3
		Good in some life science areas	5
		Provides a dimension not otherwise possible	3
Secondary Teachers	23	Excellent resource people available	3
		Promotes cooperative attitudes	4
		Way of stretching budget	5
		Great Public Relations	4
		Insures technology is approached	3
		Shows importance of science in daily living	4
Supervisors	19	Many examples of worth	3
		Good way to get constructive input	4
		Needs to work both directions	5
		Can also increase financial support	3
		Good way of approaching careers	4
Teacher Educators	11	Science should reflect community	3
		Such involvement suggests a new kind of science	5
		Good to encourage out-of-class science	3
Researchers	9	Will enhance local support for school as well	2
		Good to include aids	3
		Good to use local experts	2

N = Number of Respondents
F = Frequency of Responses

TABLE D 18.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	7	Need careful planning	4
		Be sure people and places are checked out	3
Secondary Teachers	15	Need to have clear policy	5
		Government regulations interfere	3
		Field trips still too costly	3
		School should be prepared to pay for it	4
Supervisors	16	School officials should be in control	7
		Could also restrict	4
		Need proper leadership	5
Teacher Educators	16	May be easier to suggest than to do	5
		Depends on nature of involvement	4
		Needs careful planning and organization	5
		Need to emphasize that it is a two-way structure	2
Researchers	9	Could also dilute education	3
		Could be prescriptive	2
		Need guidelines	4

N = Number of Respondents
F = Frequency of Responses

TABLE D 18.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	7	Need to have adult education first	3
		Need to have system first	2
		No real evidence	2
Secondary Teachers	14	Most in community are scientifically illiterate	3
		Too restrictive	5
		No real help	6
Supervisors	8	Professionals should educate	3
		Community has no meaningful impact	3
		The concept is too idealistic	2
Teacher Educators	10	But public is "anti-science"	3
		No evidence to support importance	2
		No real community understanding of science	3
		This encourages groups like creationists	2
Researchers	6	No examples are known	3
		All too few who can contribute	2
		Too much focus on Public Relations	1

N = Number of Respondents
F = Frequency of Responses

D 19. ADDITIONAL RESEARCH IN SCIENCE EDUCATION SHOULD BE ENCOURAGED AND SUPPORTED

TABLE D 19.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	66	65	62	74	87
disagree	10	16	18	12	8
neutral	24	19	20	14	5

GRAPH D 19.1 Graphic Presentation of Respondent Ratings

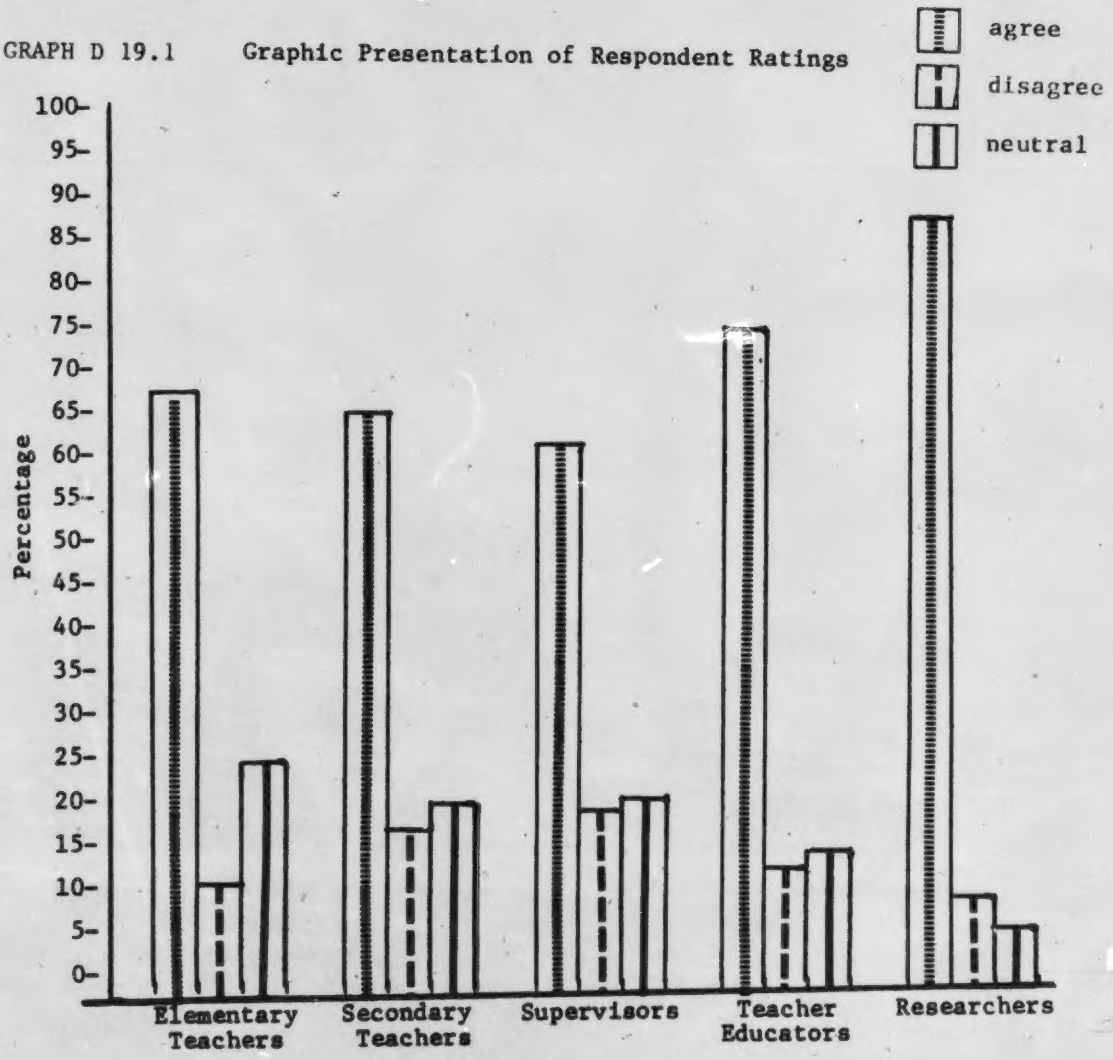
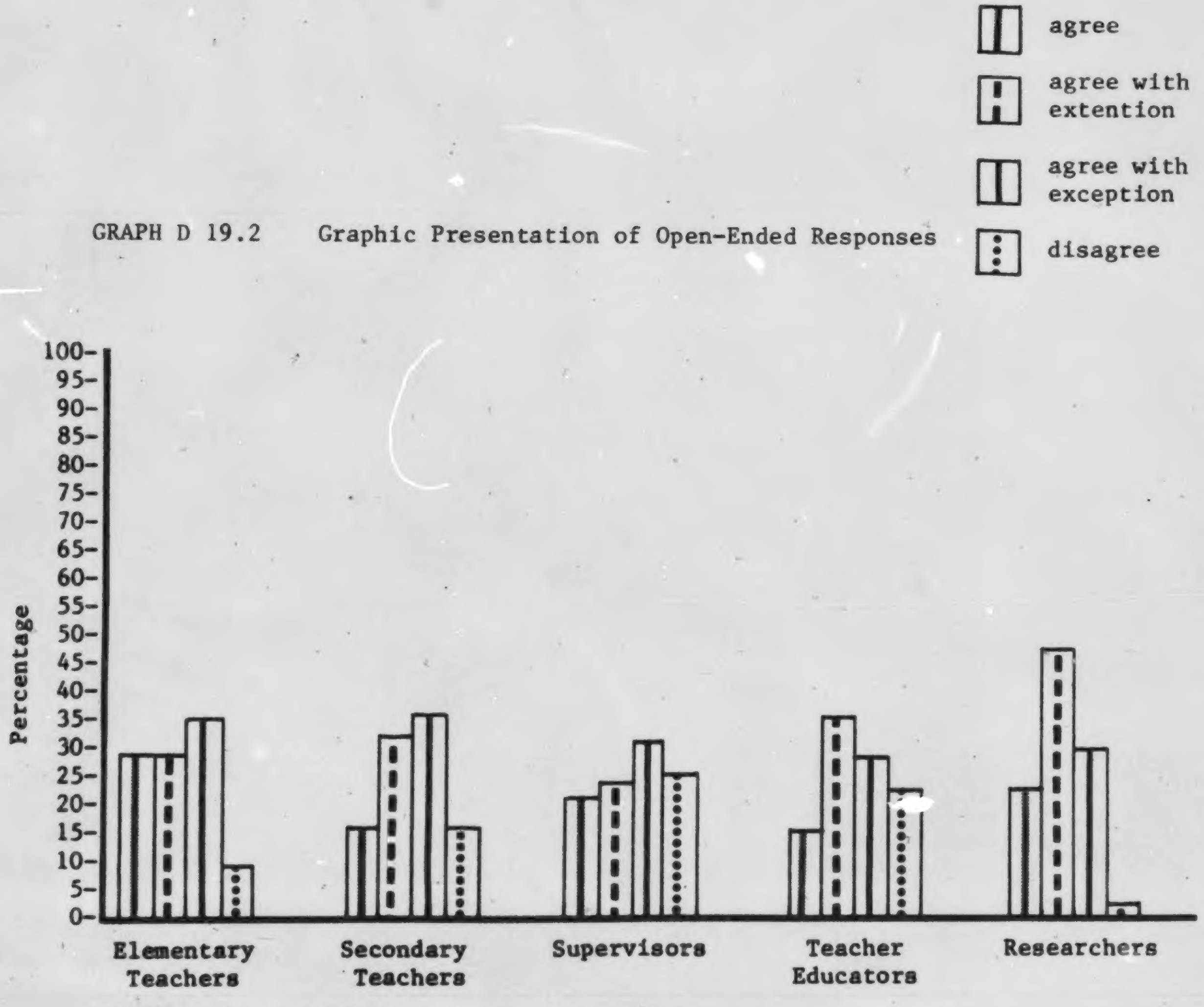


TABLE D 19.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	28	16	21	15	22
agree with extention	28	32	23	35	47
agree with exception	35	36	31	28	29
disagree	9	16	25	22	2

GRAPH D 19.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
(46)	(50)	(48)	(54)	(45)

TABLE D 19.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	13	Need more teamwork in research	4
		More time needed for doing and studying results	4
		Better communication is the key	5
Secondary Teachers	16	Best decisions arise from knowledge base	4
		Information will be major need for 80's	3
		More collaborative efforts needed	6
		Research should be reported in standard English	3
Supervisors	11	We need to put what we know into practice	2
		Need to work first on what we need to know	4
		Need to research how research findings can affect practice	5
Teacher Educators	19	Need long range studies	3
		Need cooperative planning and cooperative work	5
		Need to focus on new problems	2
		Need to research diffusion and innovation	3
		Communication is part of the effort	6
Researchers	21	Need more analysis concerning probable impact	4
		Emphasis upon practical research important for all	5
		Need to emphasize team approach to research	4
		Must be on-going and across levels	5
		Need to be sure interpretation of results demanded	3

N = Number of Respondents
F = Frequency of Responses

TABLE D 19.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	16	Emphasis must be on useful information	4
		Results (impact) to date are disappointing	5
		Research too often by and for researchers only	4
		Premium must be on research that can be applied	3
Secondary Teachers	18	Best research is field research and does not get reported as such	4
		So much research done has no meaning for classroom	7
		Much research tends to be dogmatic	3
		Too many researchers do not care about students	4
Supervisors	15	Often value falls short in practice	3
		Need immediate attempts at impact	4
		Need better links across profession	5
		Practitioners need to be involved throughout projects	3
Teacher Educators	15	Too little done currently with dissemination of information	5
		Too little relation between research and practice	5
		Research should include circulation component of all we do	3
		Some pressures in colleges are alarming	2
Researchers	13	Must maintain support of teachers	4
		Responsibility for translating into meaning for teachers	5
		Emphasis should be on "action" research	2
		Should indicate "potential" for impact	2

N = Number of Respondents
F = Frequency of Responses

TABLE D 19.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	4	Too much research makes no difference	4
Secondary Teachers	8	Need more quality research, less quantity	3
		Research to date has had minimal value	5
Supervisors	12	Perhaps too much research already done	3
		Need more support for translation of results and use of results	5
		Research in education seems worthless	4
Teacher Educators	12	Too little used that has been done	5
		Use of research findings takes time	4
		We need more quality research - not merely more research	3
Researchers	1	Impact is negligible	1

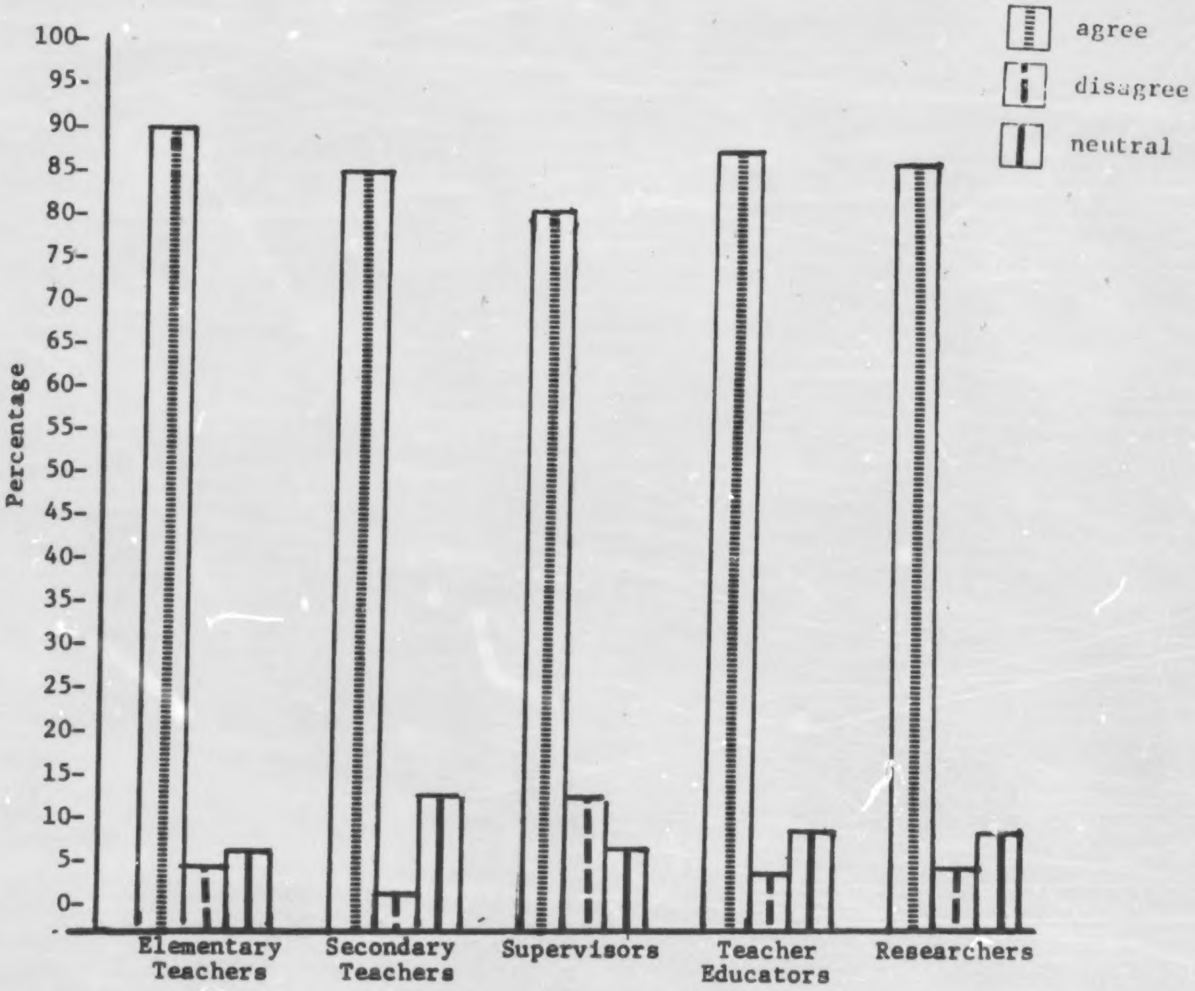
N = Number of Respondents
F = Frequency of Responses

D 20. MORE COOPERATION BETWEEN PRACTITIONER AND RESEARCHER SHOULD BE A MAJOR PRIORITY FOR THE 80's

TABLE D 20.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	90	85	80	87	86
disagree	4	2	13	4	5
neutral	6	13	7	9	9

GRAPH D 20.1 Graphic Presentation of Respondent Ratings

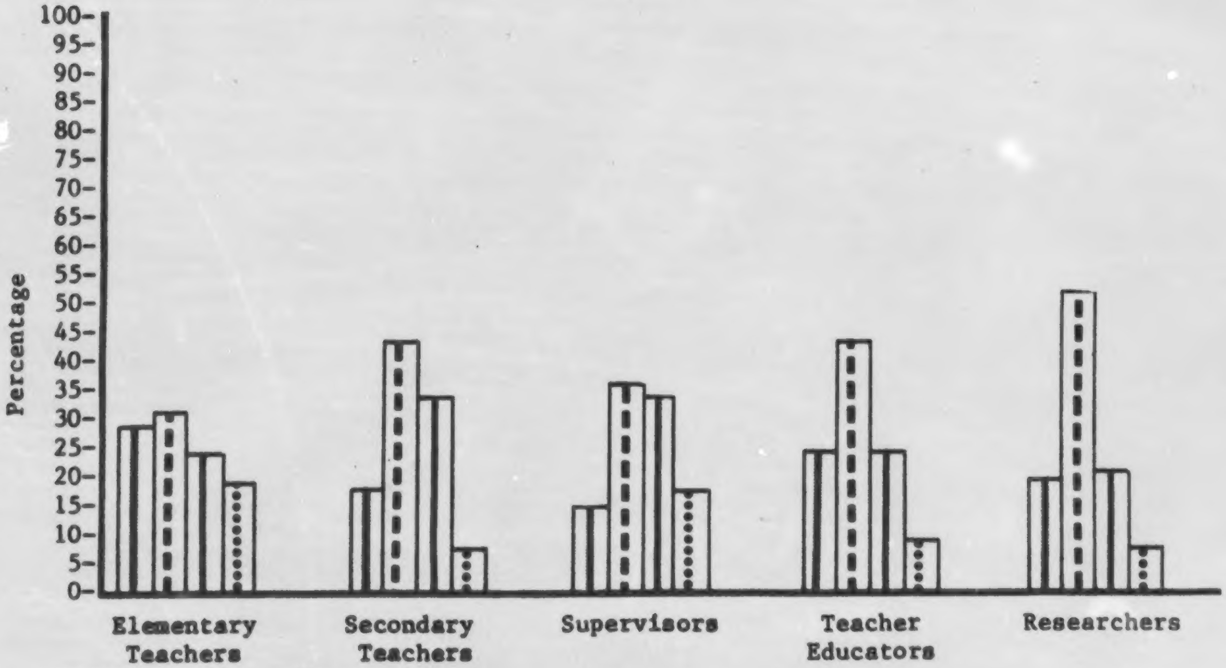


248

TABLE D 20.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	28	17	14	24	19
agree with extention	31	43	36	43	52
agree with exception	23	33	33	24	22
disagree	18	7	17	9	7

GRAPH D 20.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(39)	(46)	(42)	(46)	(42)

TABLE D 20.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	12	Research can help improve what happens in classrooms if teachers and schools are involved	5
		Need to agree on research questions	4
		Need results translated into practical terms	3
		Need real teams	3
Secondary Teachers	20	Need to start with teachers	5
		More time and encouragement is needed in schools	3
		New modes of research needed	4
		Research results must be made available in meaningful way	5
		Only succeed if really an equal partnership	3
Supervisors	15	Researchers need to be practitioners more often	3
		Need regional centers designed to help with this task	4
		Need to capitalize on schools with strong research commitment	5
		More field research needed	3
Teacher Educators	20	Need to include all levels of school professionals	2
		Need much more cooperation than is now evident	3
		Researchers need to work in real schools	4
		"Research Says" seminars are a good start	3
		Need more practical reports of completed research	4
Researchers	22	Good if cooperative efforts with graduate degrees as well	2
		Good if more practical research encouraged in general	5
		As move to consider societal issues, there will be more motivation to get together	4
		Researcher needs to teach, as teacher needs to do research	3
		Practitioners can see practical problems better	4
		Active research promotes such cooperation	4

N = Number of Respondents
F = Frequency of Responses

TABLE D 20.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	9	Elementary school teachers often have no understanding of science	3
		Already too late for value in the 80's	2
		A major task to accomplish	4
Secondary Teachers	15	Communications must improve	3
		Researchers need to be co-workers in schools	5
		Must focus on practical problems and issues	4
		Teachers need to help with communication too, not just reports to teachers	3
Supervisors	14	Great differences in definition of practicality	4
		Perhaps all cannot be equal partners in research	3
		Communication is as important as cooperation	3
		Need more school-centered activities	3
		Connection seems weak at best	1
Teacher Educators	11	Need more obvious benefits to both groups	2
		Researcher must agree to help practitioners in identifying problems	3
		Need better research designs than those in common use	4
		Cannot be researcher calling all the shots	2
Researchers	9	Budgets and time make it difficult	3
		Need more longitudinal studies conducted by faculty members	3
		Teachers need more training to be full partners	3

N = Number of Respondents
F = Frequency of Responses

TABLE D 20.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	7	Research is not necessary	3
		No real value to research	4
Secondary Teachers	3	No evidence of value	3
Supervisors	7	No evidence to suggest it will ever happen	2
		Barrier between college and schools is too great	3
		Too idealistic	2
Teacher Educators	4	Researchers are not prone to such cooperation	2
		Problem is really getting knowledge into use	2
Researchers	3	There is adequate cooperation now	3

N = Number of Respondents
F = Frequency of Responses

D 21. ENCOURAGEMENT OF WOMEN AND MINORITIES IN SCIENCE SHOULD BE A MAJOR PRIORITY FOR ATTENTION DURING THE 80's

TABLE D 21.1 Result of Respondent Ratings

		Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
Percentage	agree	65	58	58	69	77
	disagree	12	16	17	10	9
	neutral	23	26	25	21	14

GRAPH D 21.1 Graphic Presentation of Respondent Ratings

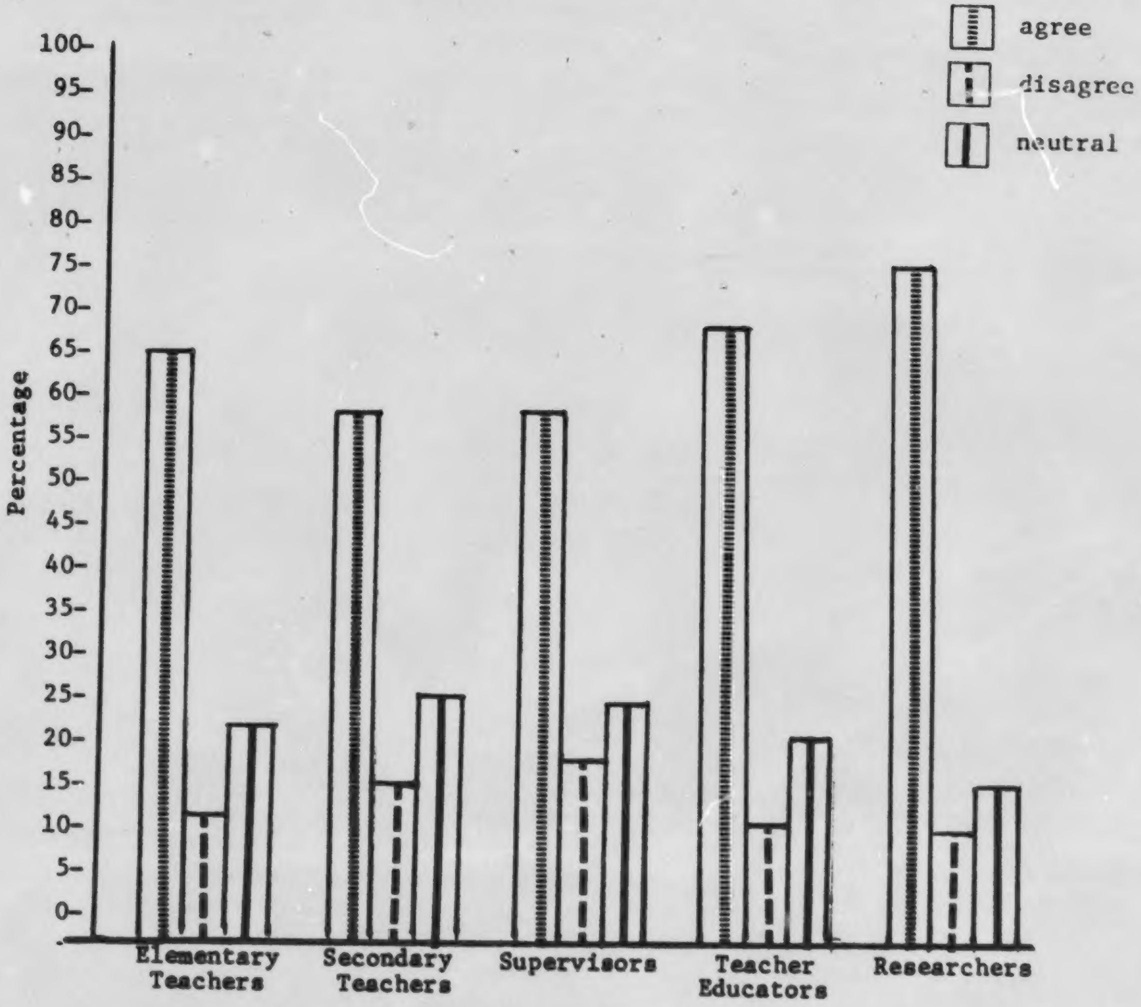
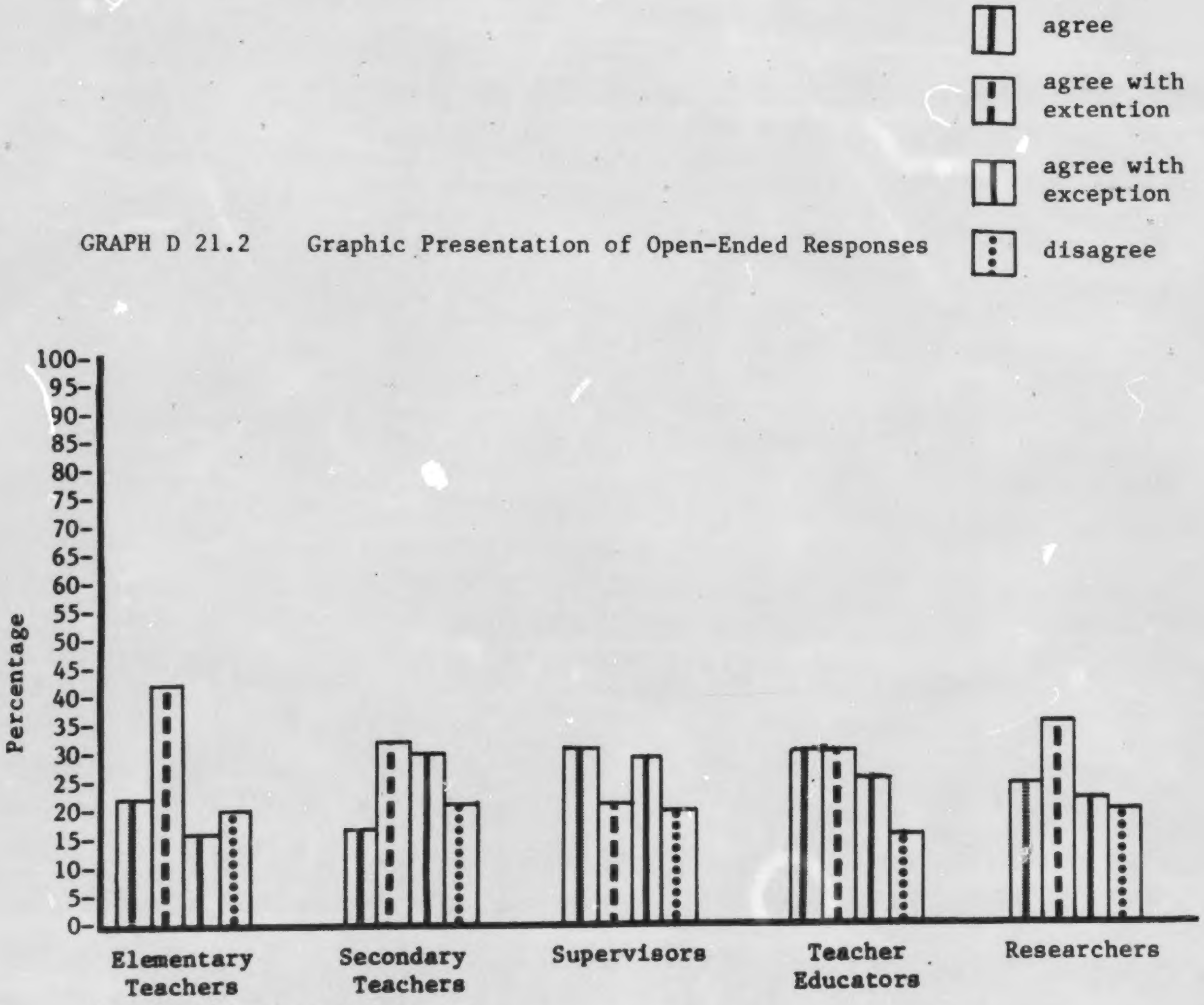


TABLE D 21.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	22	17	31	30	24
agree with extention	42	32	21	30	35
agree with exception	16	30	29	25	22
disagree	20	21	19	15	19

GRAPH D 21.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(45)	(63)	(48)	(33)	(37)

TABLE D 21.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	19	Must start early if to succeed	6
		Need to encourage all students	8
		Need better and more role models	3
		Need to be community effort	2
Secondary Teachers	20	Career awareness and encouragement needed	2
		Need equal pay and rights	3
		All should be encouraged	6
		A part of talent is being missed	3
		Science teachers are important force	3
		Need much greater diversity in science education to get to the future	3
Supervisors	10	Need to tap all talent	3
		Good examples exist (e.g. engineering)	3
		Such a focus is long overdue	4
Teacher Educators	10	Emphasis should always be on quality, regardless of race or gender	3
		Need new programs	4
		A place where science involved with general social development	3
Researchers	13	We are losing vast resources	5
		Need whole new programs	3
		Literacy needs major attention	3
		Assistance with grant writing needed	2

N = Number of Respondents
F = Frequency of Responses

TABLE D 21.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	7	Many successful without special help	2
		Such focus may be detrimental to others	5
Secondary Teachers	19	Too easy to go overboard	4
		Public attitude more important than school	3
		May be over-reaction	3
		Must maintain standards	6
		May be too tied to dollars and special programs	3
Supervisors	14	"Majority" not choosing science either	5
		Knowledge and skill in science ultimate test	3
		Not in special classes	3
		No philosophical reason for it being major focus	3
Teacher Educators	8	Much more important problems to address	3
		Problems that are bigger than science	2
		Solves a problem; does not improve science and/or science teaching	3
Researchers	8	No more than other students	3
		All those in schools not being reached are priorities	5

N = Number of Respondents
F = Frequency of Responses

TABLE D 21.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	9	Not a major priority	4
		Best to have people help themselves	2
		Everyone needs equal chance, no more	2
		Problems already being addressed adequately	2
Secondary Teachers	13	It is already happening	4
		More females enrolled in science already	2
		This is not a science education problem	3
		Not good to separate out groups	4
Supervisors	9	Seem to be making adequate progress	4
		No evidence of importance and/or need	3
		A ploy for creating class loads and new positions	2
Teacher Educators	5	More a priority for federal funding agencies	3
		Biochemical evidence now available to interpret differences	2
Researchers	7	No evidence other than availability of federal dollars	4
		Certainly not a major concern	3

N = Number of Respondents
F = Frequency of Responses

D 22. CURRICULUM DISSEMINATION AND IMPLEMENTATION ACTIVITIES SHOULD BE GIVEN A HIGHER PRIORITY BY NSF

TABLE D 22.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	76	87	93	79	48
disagree	6	3	7	7	23
neutral	18	10	0	14	29

GRAPH D 22.1 Graphic Presentation of Respondent Ratings

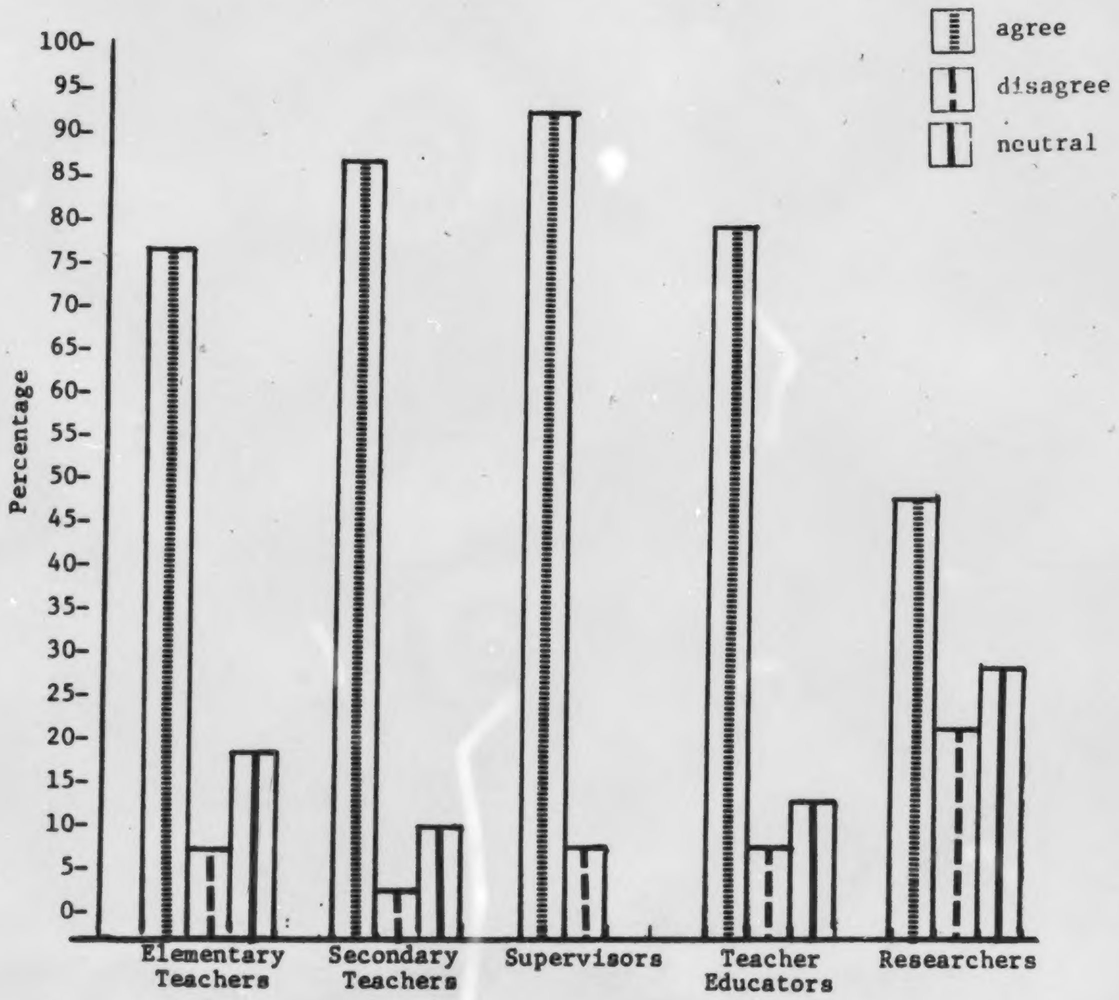
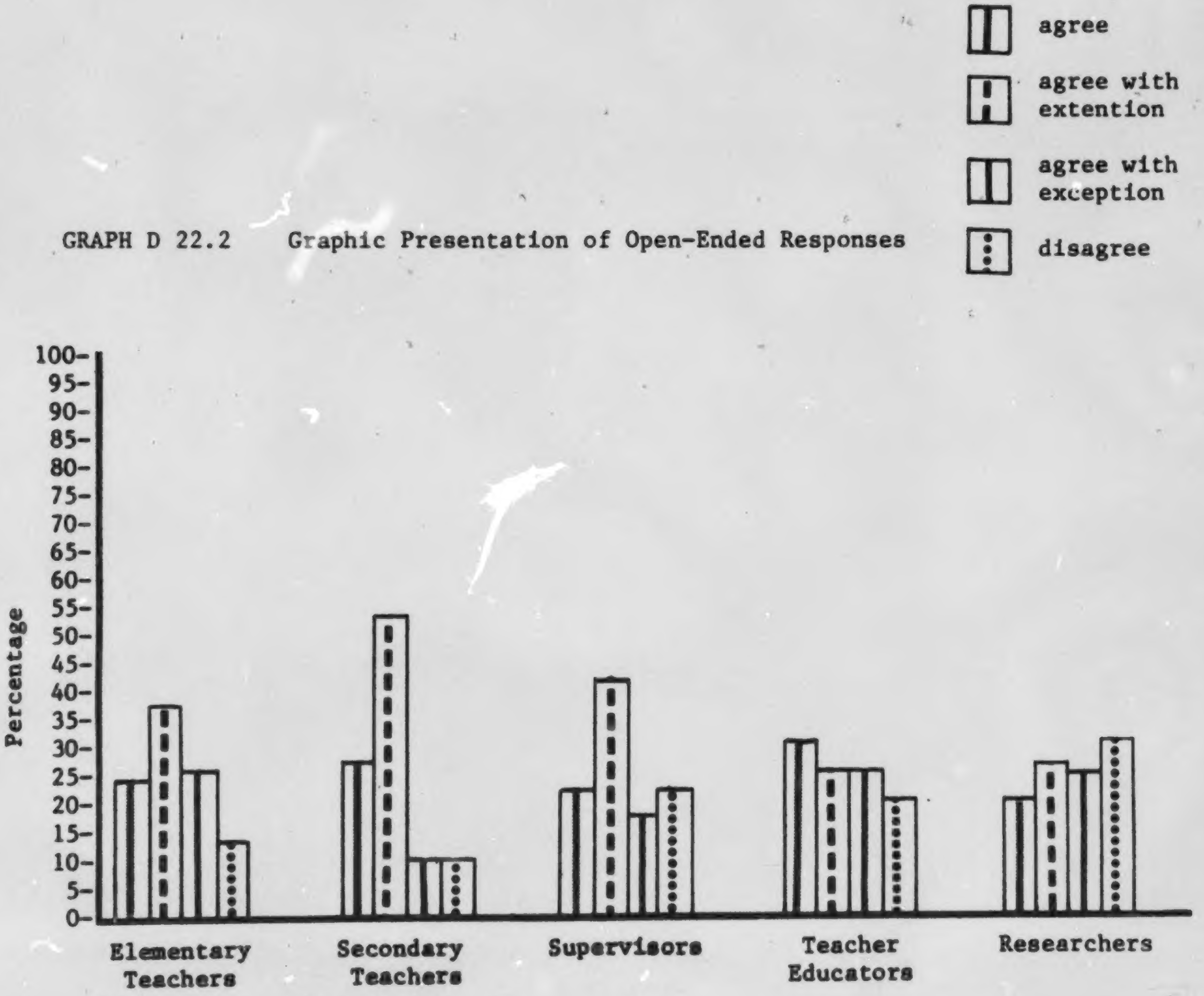


TABLE D 22.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	24	27	21	30	20
agree with extention	37	53	41	25	26
agree with exception	26	10	17	25	24
disagree	13	10	21	20	30

GRAPH D 22.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
(38)	(51)	(42)	(40)	(50)

TABLE D 22.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	14	New curricula demand such teacher help	5
		Need work on philosophy,rationale, and approaches	4
		These are basic needs - more important than most others	5
Secondary Teachers	27	NSTA should help more with correctives	4
		Reductions are a disgrace	2
		Too much erroneous advice available from publishers	3
		Need to update constantly	5
		Programs worthless without help with their intended use	4
		Evidence of past successes is in the schools	4
		Need is greater than in 60's	5
Supervisors	17	Need to spend more dollars and time on rationale/goals	5
		Need to emphasize teaching strategies - not content improvement	5
		Should be basis for pre and in-service efforts	3
		Good to have local supervisors as follow-up	2
		Colleges and universities should have broader role	2
Teacher Educators	10	Need to support use of new materials	3
		Need more attention given in NSTA publications	3
		Also need new models for dissemination and implementation activities	4
Researchers	13	In-service help a major need for future	5
		Need to work with private sector too	3
		No point of developing models if no help with using them	5

N = Number of Respondents
F = Frequency of Responses

TABLE D 22.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	10	Elementary teachers have special needs	3
		Need to be sure funds not wasted	3
		Cost for proper implementation greater than tried during 60's and 70's	4
Secondary Teachers	5	Science teachers need help with program they have	2
		NSF needs help from teachers and professional organizations	3
Supervisors	7	Need to guard against making old mistakes again	4
		Need to be sure school people are really interested	3
Teacher Educators	10	Need other public and private services as well	4
		"Support" for such activities not primary problem	3
		Should systematically review good and bad projects by outside groups	3
Researchers	12	Needs to be researched and changed based on evidence	3
		Need to be sure "new" changes more often than it did since 1960	4
		Need more general cooperation	5

N = Number of Respondents
F = Frequency of Responses

TABLE D 22.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	5	County and State agencies can help more	2
		Much waste occurred in past	3
Secondary Teachers	5	Too few teachers were affected	2
		Should be help - not just for new programs	3
Supervisors	9	Such efforts are wasted	2
		Curriculum changes have been too fast	2
		Not a desirable activity for NSF	2
		Need evidence of success of past efforts	3
Teacher Educators	8	No evidence efforts were ever affective	3
		Should be function of state agencies	3
		Should have local programs for curriculum implementation	2
Researchers	15	Should be role of state agencies	3
		National programs were a problem of the past	4
		No evidence that more support would make any difference	5
		Funds better used for research	3

262

N = Number of Respondents
F = Frequency of Responses

D 23. SUPPORT FOR INSERVICE TEACHER EDUCATION ACTIVITIES SHOULD BE GIVEN A HIGHER PRIORITY IN NSF

TABLE D 23.1 Result of Respondent Ratings

		Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
Percentage	agree	86	97	93	85	72
	disagree	2	0	5	4	10
	neutral	12	3	2	11	18

GRAPH D 23.1 Graphic Presentation of Respondent Ratings

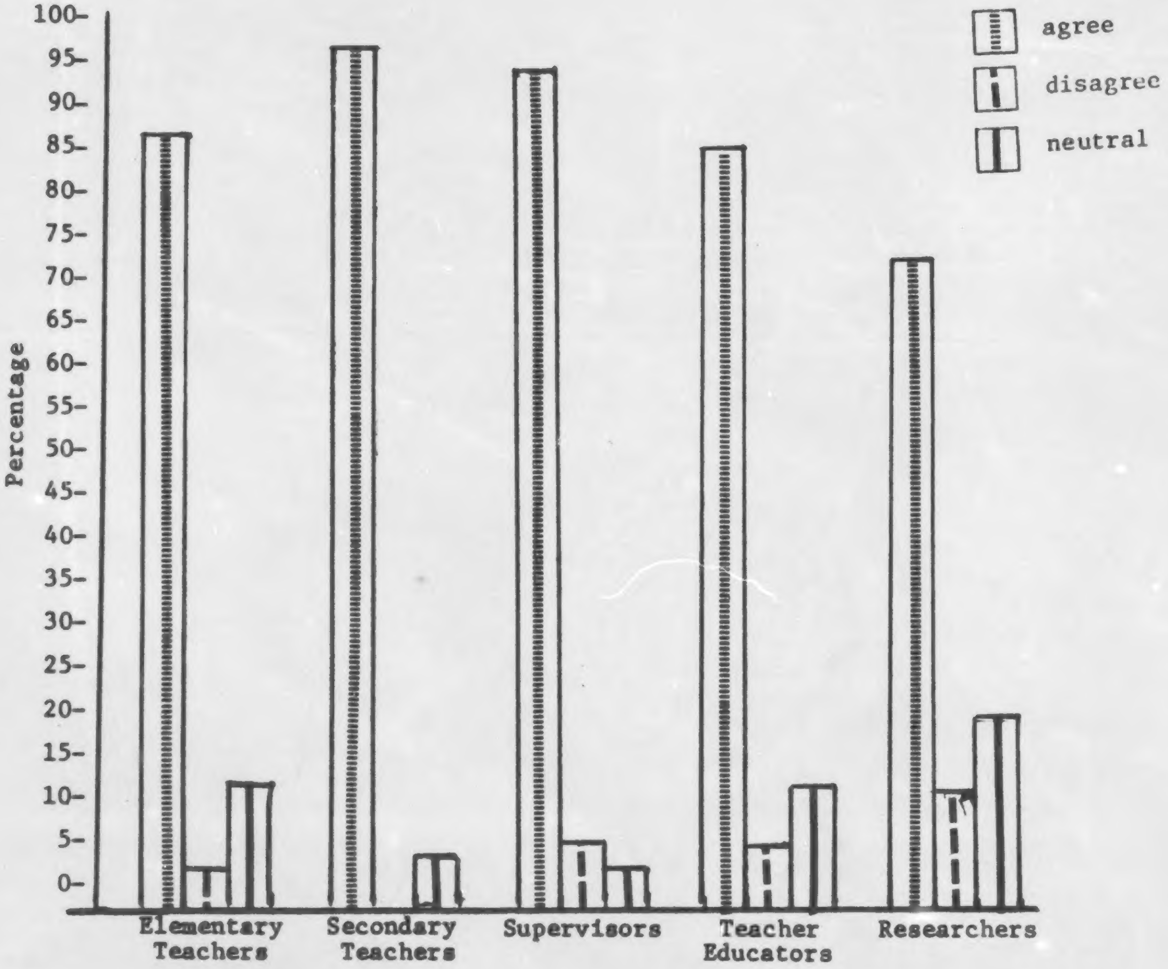
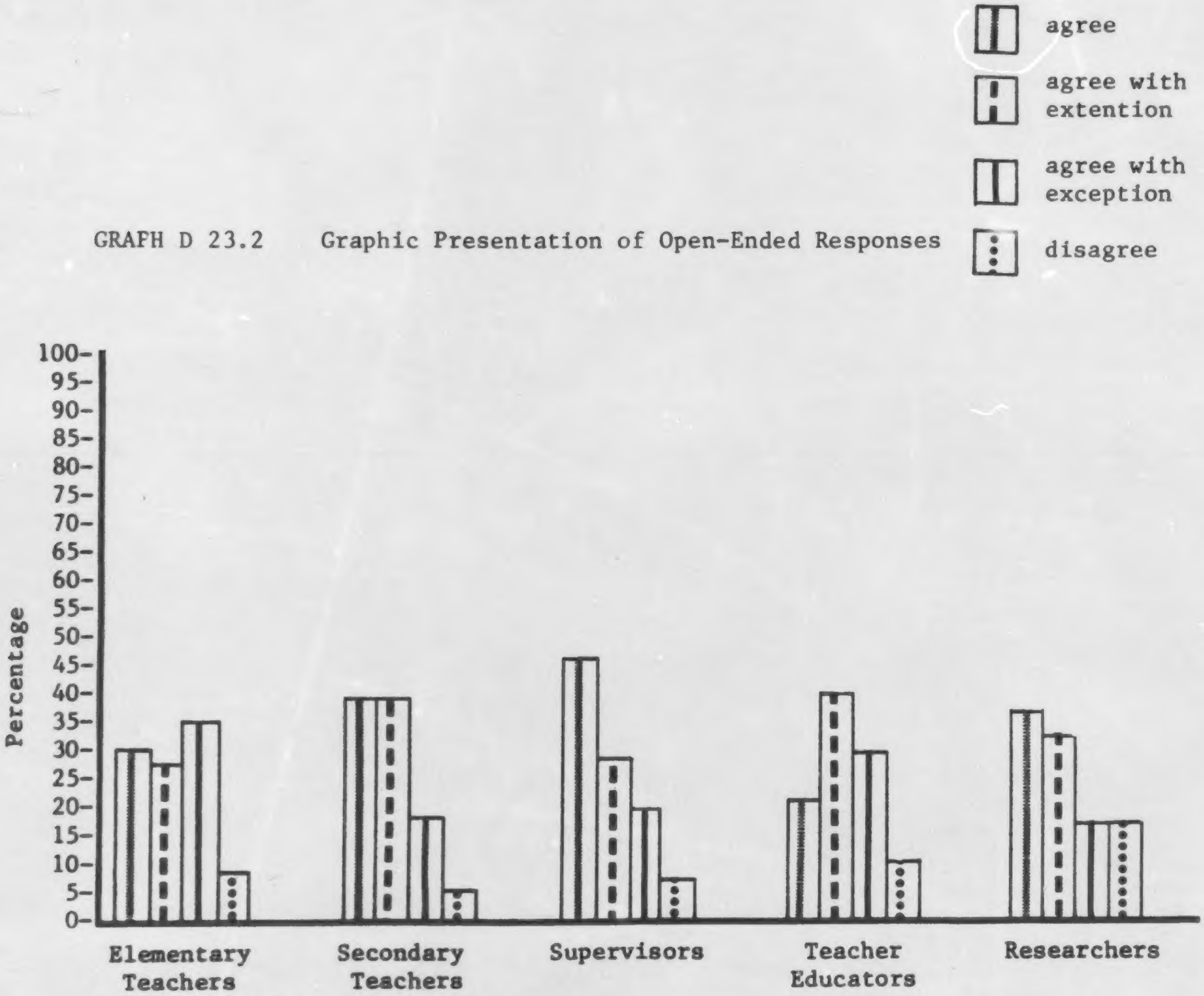


TABLE D 23.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	30	39	46	21	36
agree with extention	27	39	28	40	32
agree with exception	35	17	19	29	16
disagree	8	5	7	10	16

GRAFH D 23.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(37) (36) (43) (42) (31)

TABLE D 23.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	10	Current changes in teaching make help for teachers essential	4
		Local financial problems could be helped	3
		Only chance for success with new programs	3
Secondary Teachers	14	NSF assistance produces changes	3
		In-service programs only hope for change for many in-service teachers	3
		Let teachers help teachers	2
		Need more to consider learning theory and theory of instruction	4
		Need to include other school personnel	2
Supervisors	12	Made most impact in the past	3
		Need to try new approaches	4
		Good interaction with other professionals	5
Teacher Educators	17	Need new ideas in system	3
		Elementary teachers are in dire need	2
		Matching funds should be tried	3
		Need to get full benefit from new programs	4
		Need other sources of funding as well	3
		Science curriculum should be changing constantly, so such help needed	2
Researchers	10	Need new models for in-service	2
		Should be major target for science education activity for 80's	2
		Need long-term commitment - five years	2
		Need to be part of total effort	4

N = Number of Respondents
F = Frequency of Responses

TABLE D 23.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	13	Others misused in past	3
		Also other for administrators/supervisors	3
		Other agencies could/should help	4
		Need to be more cost effective	3
Secondary Teachers	6	Should be part of total effort	4
		Need to consider out-of-school activities as well	2
Supervisors	8	Need to correct problems of past efforts	3
		Need to subsidize teacher training	2
		Need local decisions on program first	3
Teacher Educators	12	Nature of in-service must be specified	2
		Old models did not work	3
		Level must be drastically increased	3
		More commitment from teachers or schools should be demanded	4
Researchers	5	Other local and state agencies must help	2
		Need to study success strategies this time	4

N = Number of Respondents
F = Frequency of Responses

TABLE D 23.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	3	Most in-service courses are game-playing	2
		NSTA's Drive-In Conferences could help	1
Secondary Teachers	2	Too many of the past programs were worthless	2
Supervisors	3	No evidence of value in past	3
Teacher Educators	4	Little value seen from past efforts	4
Researchers	5	In-service should be supported by state or locally	2
		Little value of efforts during the 60's	2
		In terms of total budget, this is a priority for NSF	1

N = Number of Respondents
F = Frequency of Responses

D 24. FINANCIAL SUPPORT FOR SCIENCE EDUCATION SHOULD BE SIGNIFICANTLY INCREASED FOR THE NEXT DECADE

TABLE D 24.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	78	87	82	71	72
disagree	8	3	6	10	13
neutral	14	10	12	19	15

GRAPH D 24.1 Graphic Presentation of Respondent Ratings

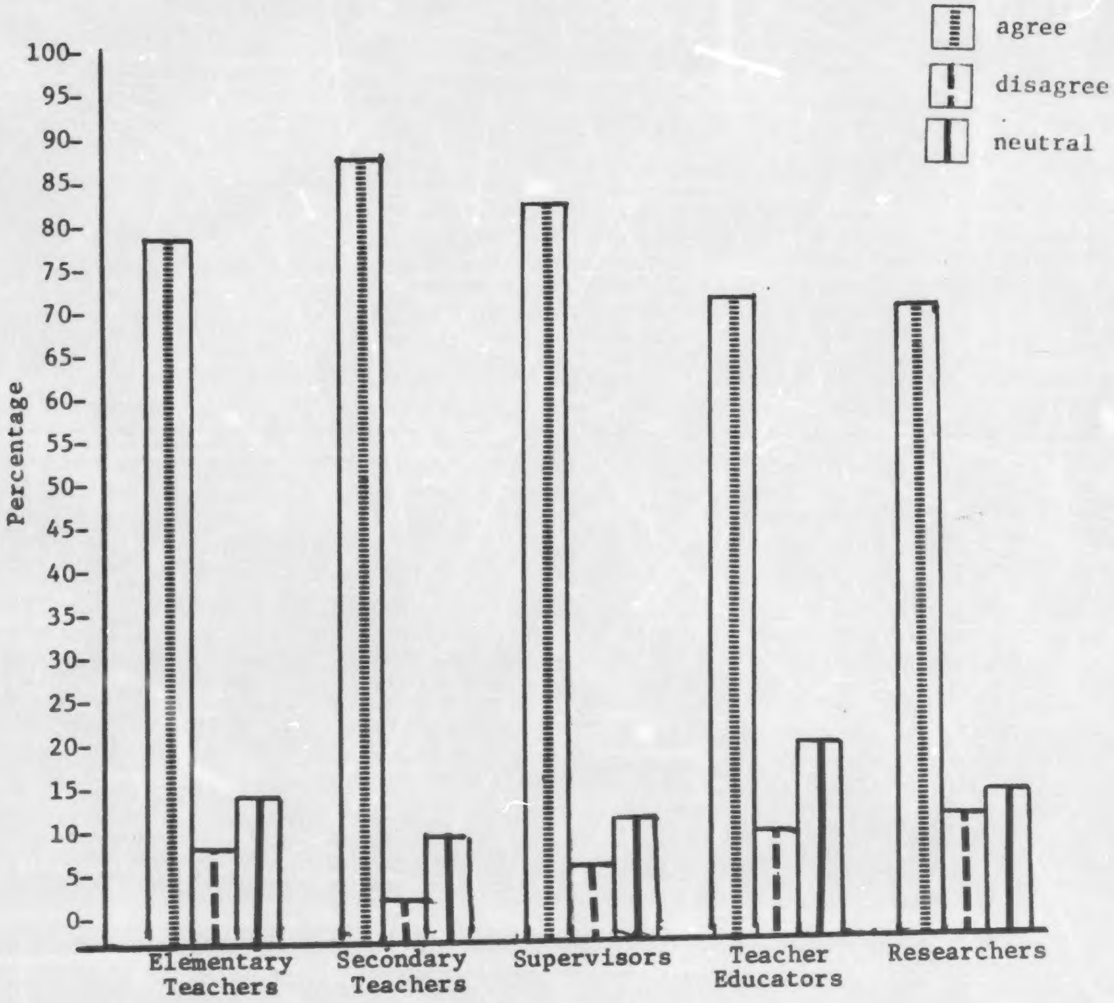
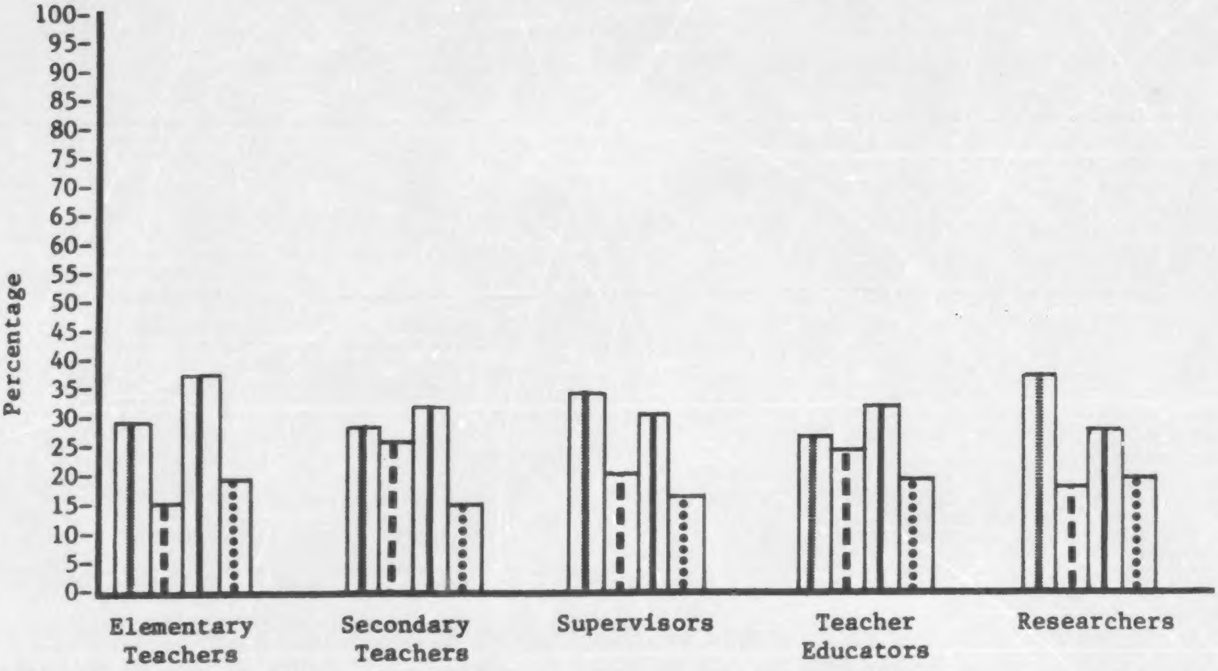


TABLE D 24.2 Categorization of Open-Ended Responses*

		Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
Percentage	agree	29	28	34	26	37
	agree with extention	15	26	20	23	17
	agree with exception	37	32	30	32	27
	disagree	19	14	16	19	19

GRAPH D 24.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
(41)	(43)	(44)	(47)	(41)

TABLE D 24.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	6	Change generally takes funding to implement	3
		Need better public relations with public and government officials	3
Secondary Teachers	11	Need look for alternative funding sources	2
		Difficult to move forward new goals without support	4
		Need to support a unified profession	2
		Need more active attempts to tell "Science Education Story"	3
Supervisors	9	Problems today are greater than during 50's and 60's	3
		Need greater local responsibility	3
		Need teacher center concept advanced	3
Teacher Educators	11	Need more information to use in this effort to regain financial support	3
		Some funds are needed if we chart new paths	5
		Matching funds may be a direction	3
Researchers	7	Need look at all sources of funds	3
		Funds should go with big ideas	4

N = Number of Respondents
F = Frequency of Responses

TABLE D 24.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	15	Ideas and teachers are more important	3
		Need more efficiency	6
		Local districts must beware of "soft" money	2
		Other agencies - public and private - must help	4
Secondary Teachers	14	Existing programs must be modified	3
		Need to use all resources wisely	3
		Guidelines and restraints that come with funding are a problem	4
		Must be more in unison than it is now	4
Supervisors	13	Whatever expenditures must come from perceived need locally	5
		Other sources for funds may be better	4
		Money does not make an effective program	4
Teacher Educators	15	Need agreement on directions	3
		Need to have evidence of likely successes	4
		Should also use existing resources more efficiently	3
		The most attractive new goals do not require major expenditures	5
Researchers	11	We need to use what we have more efficiently	2
		We can not rely on federal funds	2
		New ideas must be advanced first	3
		Let's agree on our needs and directions	4

N = Number of Respondents
F = Frequency of Responses

TABLE D 24.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	8	Elementary science can rely on students and home	2
		Private industry can help	2
		Federal money is not answer	4
Secondary Teachers	6	Funds better spent at local level	2
		Better management, more efficiency are real needs	4
Supervisors	7	No evidence for benefits from past dollars	4
		Funding for schools should not come from national sources	3
Teacher Educators	9	New directions are more important than funds	2
		Local districts and state sources should help	3
		Money is not our major problem	4
Researchers	8	Money for equipment, supplies, materials is often a waste	3
		Support should come from·local and state sources	2
		Idea vacuum is greater problem	3

N = Number of Respondents
F = Frequency of Responses

D 25. SCIENCE EDUCATION COMMUNITY SHOULD CONSTANTLY ASSESS ITS NEEDS, DEFINE ITS PROBLEMS, AND ESTABLISH NEW GOALS

TABLE D 25.1 Result of Respondent Ratings

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	96	90	96	93	87
disagree	2	0	1	3	11
neutral	2	10	3	4	2

GRAPH D 25.1 Graphic Presentation of Respondent Ratings

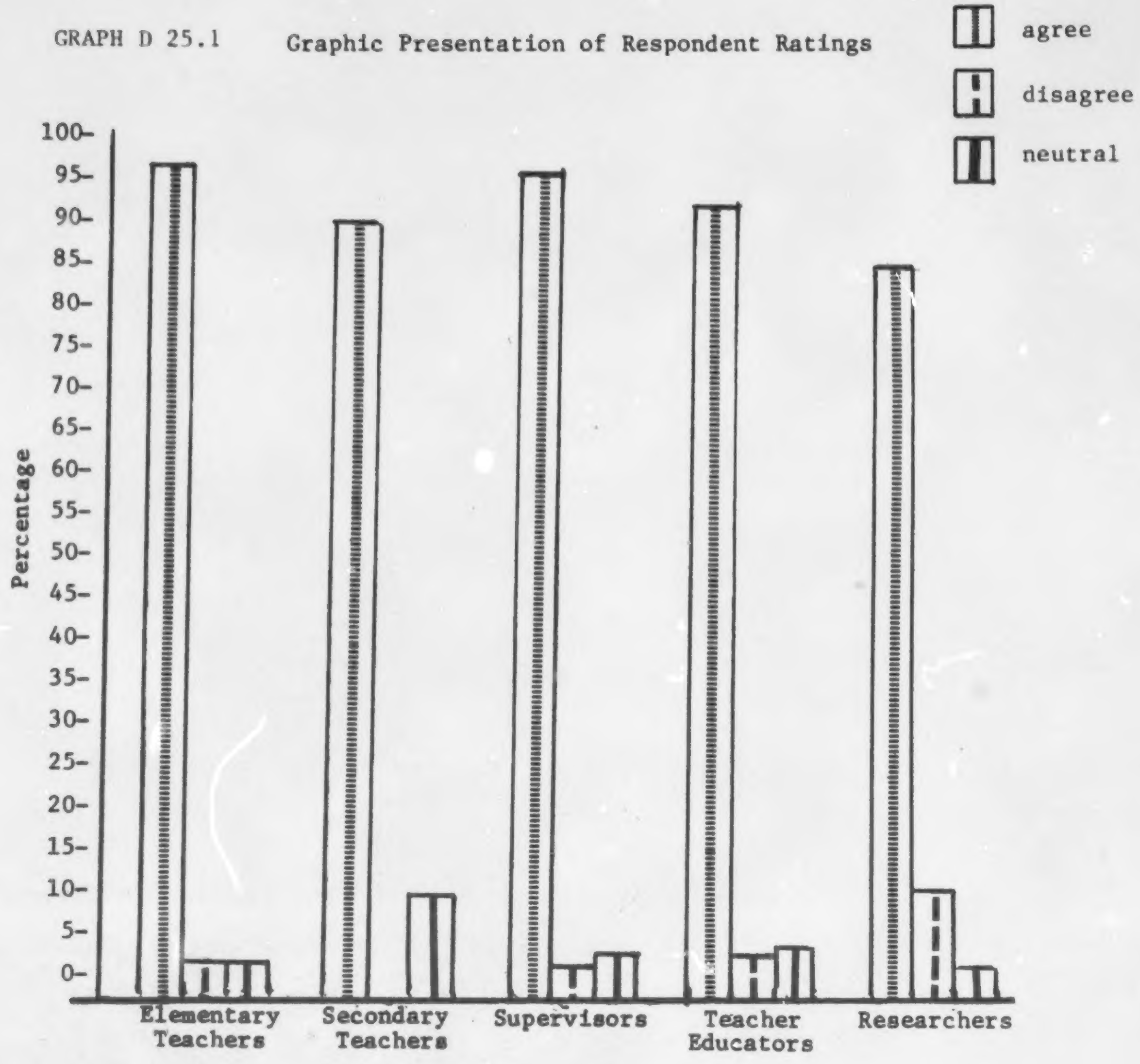
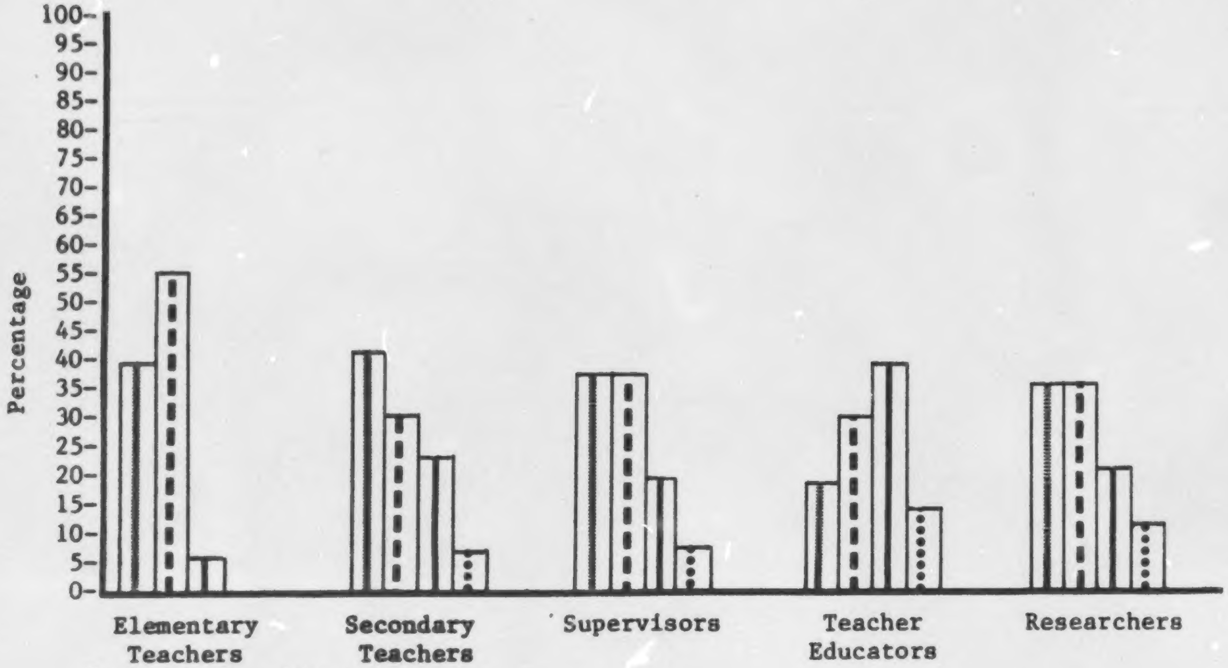


TABLE D 25.2 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
agree	39	41	37	18	35
agree with extention	55	30	37	29	35
agree with exception	6	23	19	39	19
disagree	0	6	7	14	11

GRAPH D 25.2 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
(31)	(47)	(43)	(44)	(26)

TABLE D 25.3 Tabulation of Open-Ended Responses Which Extend the Position

Group	N	Summary of Responses	F
Elementary Teachers	17	Such action encourages growth and improvement	6
		Evaluation should be part of effort as well	5
		Such efforts are at heart of scientific enterprise	3
		Should include differences as to educational level as well as geography	3
Secondary Teachers	14	NSTA should be at center of such activities	5
		New direction is our most critical need; this will help us get it	4
		Need to use state, local, and national efforts	3
		Especially true with school programs	2
Supervisors	16	Not always a response to crisis	3
		Good basis for professional dialogue	4
		Need better professional domain	3
		Need practical statements in each category	4
		Need a "rational" needs assessment	2
Teacher Educators	13	Need an organized voice	3
		Need better communication system	6
		Provides framework for action	4
Researchers	9	These activities should be central to our profession	4
		All of education is part of and product of society	3
		The "science" part of our profession	2

N = Number of Respondents
F = Frequency of Responses

TABLE D 25.4 Tabulation of Open-Ended Responses Which Take Exception to the Position

Group	N	Summary of Responses	F
Elementary Teachers	2	Need to be sure all problems considered, not just curriculum ones	2
Secondary Teachers	11	"Periodically" better than "constantly"	3
		Need to be sure time for action as well	5
		Need better system for communication	3
Supervisors	8	Need to be sure a specific group is in charge of effort	3
		Need to review all levels; of equal importance	2
		Concensus is unlikely	3
Teacher Educators	17	"Continously" better than "constantly"	2
		Must involve profession as a whole	4
		Not at expense of all else	5
		Need to be sure all professionals of all ages involved	3
		Need to think of recipients, i.e., learners	3
Researchers	5	Need to use new knowledge and ideas	4
		Need to consider other actions as well	2

N = Number of Respondents
F = Frequency of Responses

TABLE D 25.5 Tabulation of Open-Ended Responses Which Disagree with Position

Group	N	Summary of Responses	F
Elementary Teachers	0		
Secondary Teachers	3	Science education not a community	3
Supervisors	3	We know needs, problems, and goals already	3
Teacher Educators	6	"Assessing" is a waste of time	3
		Already being done - problem is accomplishing them	3
Researchers	3	Need to be more concerned with action	3

N = Number of Respondents
F = Frequency of Responses

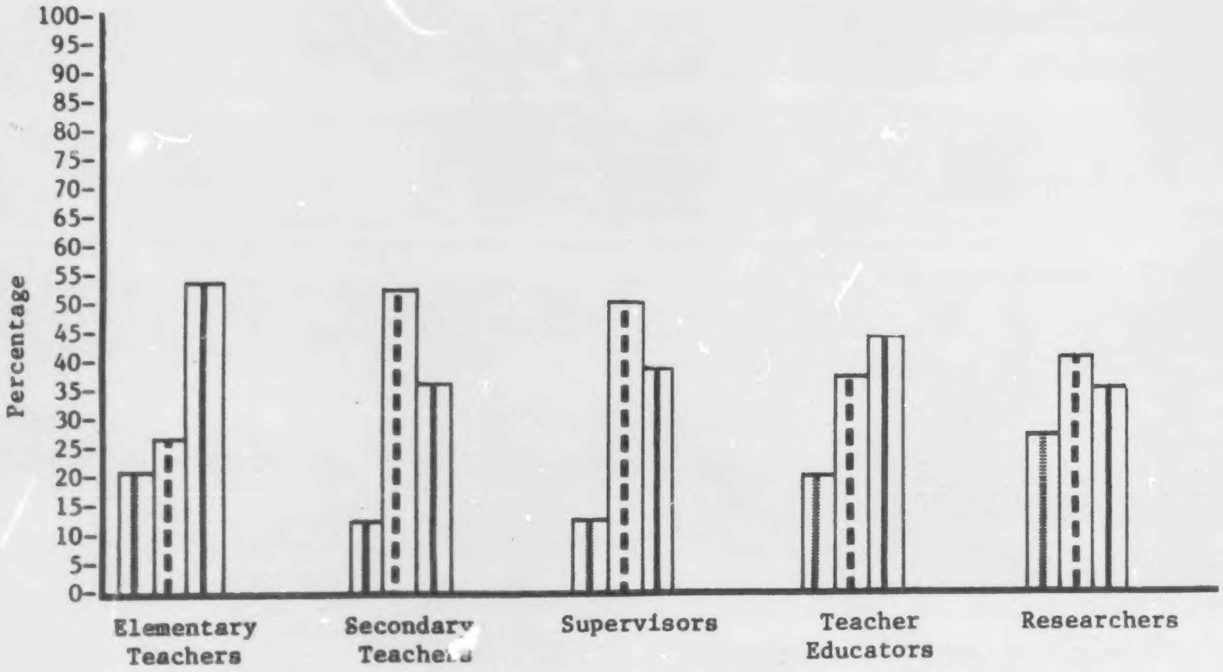
D 26. GENERAL REACTION TO "RECOMMENDATIONS FOR COMING YEARS"

TABLE D 26.1 Categorization of Open-Ended Responses*

Percentage	Elementary Teachers	Secondary Teachers	Supervisors	Teacher Educators	Researchers
excellent	21	12	12	19	26
satisfactory	26	52	50	37	40
disappointing	53	36	38	44	34

▯ excellent
▯ satisfactory
▯ disappointing

GRAPH D 26.1 Graphic Presentation of Open-Ended Responses



*Numbers Providing Comments

(57) (42) (42) (54) (35)

TABLE D 26.2 Tabulation of Open-Ended Responses Listing the Points of Disagreement

Group	N	Summary of Responses	F
Elementary Teachers	30	Format is burdensome	8
		Too much on science for special groups	5
		Sections dealing with student attitude and achievement are poor	4
		Poor treatment of teachers and subject matter competency	3
		Seems to have poor understanding of Piaget's work	3
		Need more focus on recommendations and how they can be met	3
		Too much emphasis on federal funding	2
		Old programs were too difficult and gimmicky	2
Secondary Teachers	15	Too few new ideas	3
		Reads like a committee effort (all things to all people)	2
		Recommendations are too timid	2
		Too little on technology and instruction	2
		Junior high/middle school poorly tested	2
		Too little understanding of importance of material in basic courses	2
		Too much emphasis on funding	2
Supervisors	16	Poor writing, unimaginative	7
		Too much a "victim" of 60's in philosophy	4
		No substance	3
		Does not develop case for recommendation	2
Teacher Educators	24	Nothing new, no vision	7
		Recommendations not clear	5
		Too general, vague	4
		Too much "in house"	3
		Too little emphasis on learning (birth to grave)	3
		Too much influence of government	2
Researchers	12	Experience with science in general preferable to some one dimension of it	3
		Too much emphasis on competence instead of literacy	3
		Need more emphasis on personal and local solution	2
		Too much argument for "more of the same"	2
		Fails to emphasize classroom teacher as key	2

N = Number of Respondents
F = Frequency of Responses

III. General Analysis of Working Paper

This section of the report is divided into four sections - each a different look at the data reported in Part II. First, a review of the general results of the survey with respect to the four major sections of the working paper is presented. Second, the data are reviewed with identification of specific positions where there is greatest agreement among members of the current leadership in science education. Third, a similar presentation is offered concerning the areas of greatest disagreement for positions taken in the paper. A fourth aspect of the general analysis is concerned with the areas where there is greatest divergence of opinion among the five responding groups.

A. Review of Each Section of the Working Paper

The Introduction of the working poaper was judged to have been the most successful of the four sections of the paper. It provided a setting for the analysis while also outlining a larger domain for science education as a discipline. This section of the total report received by far the greatest number of excellent ratings by respondents in all five sample groups. The interdependence of society and science teaching was noted as a point of departure as well as a needed focus in science teaching. The position that societal problems should provide the most significant influence upon science teaching in future years was suggested by over 50 percent of the sample. However, this general agreement was often qualified with many respondents questioning the designation "the most" significant influence. The degree of agreement would likely have been higher had the statement merely identified societal problems as one significant focus for science teaching. This position is surely supported by the analysis of the aims section of this paper.

The Aims section of the paper was rated as generally satisfactory by most respondent groups. The range for classifying the section as disappointing ranged from 38 to 49 percent of the five responding groups. There was general agreement that professionals have generally agreed on the goals of science teaching for the past 40 years (Table B 1). However, there was also general agreement (though not as decisive) that current goals of science teaching are in a period of significant transition. There is further agreement that the profession should expect changes in goals, curriculum, and strategies for teachers to use in meeting goals and in using new curriculum materials. There is also general agreement about the appropriateness of one goal of science teaching being the attainment of scientific literacy for all. There is agreement that NSTA's previous descriptions of a scientifically literate person remain valid. However, several new dimensions to the definition are proposed.

There are interesting differences among the groups of respondents (teachers, supervisors, teacher educators, and researchers) concerning goals, definitions, and the desirability of change. Some of these are identified in Part D of this section. Except for the fact that only 40 percent of the teacher educators agree that goals of science teaching are in transition, all sample positions from the original paper produce agreement on the part of 50 percent or more of the respondents in each group for each of the four items selected for reaction. This generally favorable view of the individual items in this section makes the "disappointing" reaction for 40 percent of all respondents somewhat surprising. Only the section concerned with recommendations for the future was reviewed as more disappointing.

Another surprising observation to this section is the seeming inconsistency of the positions taken. There is strong agreement that goals have been quite consistent for the past two decades while also agreeing that current goals are in transition. There is agreement that the previous descriptions of scientific literacy are as accurate today as they were ten years ago while there is agreement that change in goals, curriculum, needs, and teaching strategies are expected.

Perhaps the low rating for this section of the report is caused by this vacillation. There seems to be a lack of common direction, a conciseness, a philosophy. If the aims section was meant to establish such direction for identifying and discussing past accomplishments as well as future needs, it does not seem to have functioned in this manner - even though there is agreement within the leadership of the profession with many of the individual statements and positions.

The third section of the report was concerned with the Present Situation of science teaching. It consisted of a section dealing with sources of satisfaction and hope and a section dealing with current issues and concerns. The general rating for the section for all groups was satisfactory; the number of excellent and disappointing designations are nearly equal for the two teacher groups and for supervisors. None of the researchers rated the section as excellent and far more of the teacher educators rated it as disappointing than rated it as excellent. Even with these ratings this section stands next to the introduction in terms of positive response about its appropriateness in meeting its objectives.

Four positions from the paper were selected to assess professional opinions regarding the sources of satisfaction and hope for discussion in the Present Situation part of the working paper. These four positions (C 1 through C 4) deal with the significance of the curriculum efforts 1959-79, the continuum of curriculum development from the 1960's to the present, NSF institute programs causing changes in teacher behavior, and the continuing importance of teachers' knowing more about specific strategies for accomplishing goals. There is general agreement for these positions - sources of satisfaction and hope. However, there are apparent dichotomies in the assessment when the various respondent groups are considered. Generally fewer than 50 percent of the teacher educators and researchers agree with these positions which claim that the occurrences during the 60's and 70's represent sources of satisfaction and hope. These differences are discussed more fully in Part D of this section.

Six areas of current concern in science education were identified by the original authors. These six areas were population trends, budget problems, enrollment declines, accountability/competency-based programs, vastly different students today compared to past times, and teacher unionization. There was general agreement among the groups (with notable exceptions discussed later) that there are concerns. Teacher unionization was the only concern identified where fewer than half of all respondents agreed it was a major problem. The other five problems were rated as concerns in the following order of importance: decline in funding, decline in enrollments, accountability/competency-based programs, vastly different students, followed closely by change in U.S. population. Respondents offered over 300 other important concerns in science education for the next decade as added comments. Many of these were judged as more important than the six discussed in the paper.

The fourth and final section of the working paper was concerned with Recommendations for the Future of science education. There were four subsections of this part of the paper, two major ones and two shorter ones at the end. The section was long one-half of the entire report. The general rating for the section was long one-half of the entire report. The general rating for the section was satisfactory with far more respondents rating it as disappointing than as excellent. The length, the diversity of the recommendations, and the lack of specificity of many recommendations were viewed as major weaknesses.

There were thirteen items used to measure the level of agreement among recommendations concerned with curriculum development (Tables D 1 through D 13). Although there were differences among responding groups for a given item and differences in degree of agreement among the items, there was general agreement that all twelve recommendations in this area which required a specific rating are important and valid. These recommendations included:

1) Suitable materials should be secured for good science teaching in the elementary school;

2) Diversity of content and approach should be encouraged in the junior high school;

3) Greater use of the laboratory should be encouraged because it motivates students;

4) More laboratories should be used because they improve student attitudes toward science;

5) Traditional offerings in science should be expanded and organized in ways other than by discipline;

6) Science in the community college should be more flexible and varied than in K-12 settings;

7) Laboratories should be considered vital parts of introductory science courses at the college level;

8) Elementary education majors should complete formal preparation in all major disciplines of science;

9) Increased attention to content preparation for K-12 should be given a high priority;

10) Renewed attention to teaching science as inquiry should be a major goal;

11) Improvement of teaching strategies should be a major concern;

12) Budget needs for equipment, supplies, and other materials for science instruction should be addressed.

The second major subsection of the recommendations section was concerned with the improvement of teaching. Several specific items were used to assess the validity of the positions advanced in the paper. These included greater attention to: in-service teacher education; provision for consultant assistance; greater involvement of schools in preservice programs; greater use of competency-based teacher education programs; greater involvement of community personnel in curriculum, teaching, and direct experiences for students; additional research for better information on which to base decisions; and more cooperation between practioners and researchers. Except for the recommendation dealing with competency-based teacher educator programs (when fewer than 50 percent of the supervisors, teacher education and researchers agreed), the recommendations in this area were reviewed favorably by all groups (Chart D 19.1).

The last two short subsections dealt with recommendations concerning the encouragement of women and minority students in science and increased federal funding for science education.

The level of agreement concerning these five sample recommendations from the working paper was very high.

As in the case of other sections the generally satisfactory rating for this section seems more critical than the individual ratings on specific items would suggest. Again, the problem seems to be with precision, clarity and style more than with disagreement about specific points the authors advance.

B. Review of General Areas of Greatest Agreement With Positions Taken in the Working Paper

This discussion centers upon an elaboration of specific positions where there is general agreement of 65 percent or more by all respondents in the sample groups. The presentation will identify those items where all respondent groups agree on that item at the 65 percent level or higher and examples where only four groups agree with a given position at the 65 percent level.

The following items are positions where 65 percent or more of all five respondent groups agreed:

1) Changes with respect to goals, curriculum, and teacher strategies are to be expected in science teaching (B 4);

2) The development of science curriculum materials during the 1959-79 period were significant achievements (C 1);

3) Decline in funding for science education is a major concern for the 80's (C 6);

4) Laboratories should be vital parts of science courses at the college level (D 7);

5) Improvement of teaching strategies should be a major concern for the 80's (D 12);

6) Renewed attention to inservice teacher education should be a major priority* (D 14);

7) Schools and school personnel should be involved to a greater degree in preservice teacher education (D 16);

---

*Over 90 percent agreement for all groups.

8) Greater community involvement in science curriculum, teaching, and direct student experiences should be encouraged (D 18);

9) More cooperation between practioner and researcher should be a major priority (D 20);

10) Support for inservice teacher education should be given a higher priority (D 23);

11) Financial support for science education should be significantly increased for the next decade (D 24);

12) The science education community should constantly assess its needs, define its problems, and establish new goals (D 25).

The following items are those where four responding groups agree at the 65 percent level or higher. The one group with a lower rating is indicated with each statement in the following list:

1) The interdependence of society and science teaching is a point of departure for a discussion of accomplishments and needs - except elementary teachers (A 1);

2) The NSTA description of a scientifically literate person continues to be as accurate a description as when it was prepared a decade ago - except researchers (B 2);

3) The decline in number of students in science classes is a major cause for alarm - except researchers (C 7);

4) Shortages of suitable materials for elementary school science should be corrected - except researchers (D 1);

5) Laboratories should be encouraged because they tend to improve student attitudes toward science - except researchers (D 4);

6) Attention to the employment of additional science consultants and other support staff should be a major priority - except secondary teachers (D 15);

7) Additional research in science education should be encouraged and supported as a base for making decisions for future actions - except supervisors (D 19);

8) Curriculum dissemination and implementation activities should be given a higher priority by NSF - except researchers (D 22).

The greatest agreement for the areas assessed is represented by the above both in terms of percent agreement within groups and agreement across the five respondent groups as well. The 20 areas indicate major priorities for science education. It is interesting to note that 14 of the 20 areas of agreement came from the recommendations for the future section of the report. These needs are surely ones that can be considered significant - both in terms of need and in terms of future direction.

C. Review of General Areas of Greatest Disagreement

This section will be concerned with positions about which there is considerable disagreement. Considerable disagreement is defined as situations where 30 percent or more of a given group of respondents disagree. Following is a listing (in order of occurrence) of situations prompting disagreement at this level.

In the Introduction significant numbers of elementary teachers disagree with the contention that the interdependence of science and society is an appropriate point of departure for a discussion of the accomplishments and needs of science education. Similarly, significant numbers in all group except researchers disagree (at the 30 percent level) that societal problems should represent the most significant influence on science teaching for the 80's.

In the goal section over 30 percent of the researchers disagreed that goals for science teaching have been static during the past forty years. Significant numbers of elementary and secondary teachers also disagree that current goals of teaching are in a period of significant transition. Many researchers also disagree that the NSTA description of the scientifically literate person is as accurate today as it was ten years ago.

In the section describing the present situation, significant numbers of teacher educators and researchers disagreed that there has been an evolutionary development of curriculum materials and recommended teaching strategies during the 1960 to 1980 period. Teacher educators and researchers also disagreed that the NSF support for teacher education activities during 1959-79 resulted in changes in teacher behavior. Many researchers also disagreed that accountability and competency-based programs represent major concerns to science education for the 80's. Teacher educators and researchers disagreed that school students are vastly different today than they were in the past. Significant numbers in all groups except elementary teachers disagreed that unionization is a major concern for science instruction in the 80's.

In the recommendation section teacher educators and researchers disagreed that elementary teachers should have formal preparation in the major disciplines of science. These two groups also disagreed that inadequate preparation in science is a major problem for science teacher education programs. Researchers disagreed that inquiry should receive continued attention as a major teaching goal. Many teacher educators and researchers both indicated strong disagreement concerning the importance of competency-based teacher education programs.

It is at once apparent that the instances where there is significant disagreement are rare. Further, the greater number of disagreements with the stated positions for teacher educators and researchers is significant. It is interesting to speculate upon the causes and/or the reasoning behind these disagreements. The open comments included in Part II of this report provide many clues and much evidence for such causes.

D. Areas of Differences Among Sample Groups

Many instances of difference among various responding groups have been mentioned earlier in this report. This is an attempt to review such disagreements as a further analysis of the data. Major differences among the groups include:

1) Elementary teachers stand alone for their relatively high disagreement for using the society-science teaching interface as a point of departure (A 1).

2) Secondary teachers agree to a much greater degree regarding the appropriateness and validity of the 1971 NSTA description of a scientifically literate person (B 2).

3) Teacher educators are unique in their disagreement that current goals for teaching science are in a period of significant transition (B 3).

4) The two teacher groups display much more agreement (77 percent and 65 percent) that curriculum changes during 1960 to the present are appropriately viewed as evolutionary ones; few disagree with the position in contrast to other groups; in fact 60 percent of the researchers disagree (C 2).

5) Teacher groups are much more positive about the value of NSF programs for stimulating changes in teacher behavior than are the other groups (C 3).

6) Elementary teachers agree to a much higher degree that teachers need to be more knowledgeable about specific strategies for meeting goals; in contrast, researchers are far less in agreement in this area than are all other groups (C 4).

7) Far fewer researchers agree about the importance of funding for the future of science education in comparison with other groups (C 6).

8) Teachers are more convinced than are other groups of the vast differences among students today than in former times (C 9).

9) Secondary teachers disagree with the position that diversity of content and teaching approach in the junior high school should be encouraged as a major recommendation for the future (D 2).

10) Secondary teachers disagree to a greater degree than do other groups with the recommendation that science offerings be expanded and organized in ways other than by discipline (D 5).

11) Researchers disagree to a greater degree than do the other groups regarding the importance of laboratories as a part of college science offerings (D 7).

12) Far more secondary teachers and supervisors agree strongly that elementary teachers should complete formal courses in life, earth, and physical science as a part of their preparatory program than do other groups (D 8).

13) Fewer teacher educators and researchers agree that inadequate preparation in science should be a major priority for improvement for the 80's than do other groups (D 9).

14) Fewer researchers view inquiry as an appropriate goal of science teaching for the 80's than do other groups (D 11).

15) Secondary teachers are less supportive of the employment of science consultants than are other groups (D 15).

16) Elementary teachers give more support than other groups for greater involvement of schools and school personnel in preservice programs (D 16).

17) Researchers and teacher educators are far less supportive of the expansion and importance of competency-based teacher education programs than all other groups (D 17).

18) Supervisors are less supportive than all other groups concerning the value of more cooperation between practioner and researcher (D 20).

19) Researchers disagree with the importance of NSF support for curriculum dissemination and implementation activities as well as other inservice activities compared with the other groups (D 22 and D 23).

20) Teacher educators and researchers agree to a lesser extent regarding the importance of greater financing of science education for the 80's (D 24).

21) Researcher show less support for constantly assessing needs, defining problems, and establishing goals than do other groups (D 25).

IV. Accomplishment and Needs in Science Education: A Summary

The NSTA Working Paper was conceived in 1976 and has been the center of controversy for five years - a period that has been characterized by many as a time of great change. Some have called the 80's a time of crisis for science education and for other professions as well. The NSTA Working Paper has been a part of the revolution; in some ways the product published in December of 1978 remains very much a working paper. In one sense to what better designation can any product of thought and science aspire?

Five hundred leaders in science education, i.e., leaders among elementary teachers, secondary teachers, supervisors, teacher educators, and researchers, have rated over forty positions advanced in the working paper. There has been majority support for nearly all of the positions. In addition these leaders have been encouraged to propose new ideas, goals, solutions, explanations. These kinds of contributions have been many and have contributed to many hours of analysis before this report could be completed.

The individual sections of the working paper were judged to be less than an outstanding treatment of any of the major topics. There was far more support for individual positions than there was for the narrative as presented in the four major sections of the paper. One of the criticisms was one of philosophy. Have the authors tried to do too much, to be too many things to too many audiences? After reading the paper and even after involvement with an extensive evaluation of it, is it possible to summarize what the authors advance as the current goals of science education? Is the present situation as described in the paper really the current one? Was it ever? What are major recommendations and what is merely explanatory information? Where is the sense of direction - the call to action?

The following summaries and critiques are offered for each section of the working paper.

Introduction. Providing a setting for science education - for a consideration of goals, priorities, and future directions - is important. The setting is a good one - one with which most people can identify. Science in a societal setting seems to be especially important in terms of current goals and needs in science education. The writing, however, could be more precise - more tuned to science education and less to society as a whole.

Aims of Science Teaching. The historical treatment of goals tended to conflict with the idea of current changes, the current crisis. There seems to be a link to the past - but unclear lines are drawn to the current goals of science education.

Some attention to the goal structure prepared by the Project Synthesis team (See NSTA What Research Says to the Science Teacher, Volume III) and to the desired goals for the future would be appropriate as this vital area is approached again.

Developing a rationale for science education that would included clear statements of new goals appears to be a major need today. The treatment of goals in the working paper is superficial and does not provide any current views other than declarations of their importance, of the necessity for continued assessment and change.

Present Situation of Science Teaching. The review of sources of satisfaction and hope for science education seems superficial and disorganized. There is no real review of the current situation, the one reflected so clearly in the three NSF status studies and the Project Synthesis effort. In many ways it was unfortunate that the NSTA paper on the interpretation of the three NSF Status Studies was not used with the Working Paper. Indeed the Status Studies provide extensive information and perspective on the current situation of science teaching - most of which is not even approached in the working paper, even though the NSF efforts and the NSTA project were parallel efforts.

The areas of concern identified in this study seem peripheral at best. Even when significant ties to some of the broader problems could be accomplished, they were not. Certainly population trends represent a significant factor for all of education. However, the problem as presented is unrelated to science education. If an analysis of specific accomplishment and needs of science education for the 80's were a goal, it has not been accomplished with this section. The ideas seem unrelated; there is no discernible attempt by the authors for a cohesive treatment of areas of concern.

Recommendations for the Coming Years. Many important points are made. However, most are lost in the extensive discussion. Again, there seems no logic and/or need for the inclusion of some discussions. Somehow the major recommendations the authors wish to make for improving science education for the 80's are lost. This study reveals that there are many extremely worthwhile points, many priorities for which there is much support. Unfortunately the twenty-five page section leaves the readers agreeing strongly with many points (See Part II, Section D of this report) but at the end not knowing what "the" recommendations are and feeling disappointed with the effort (See Table D 26.1).

The Accomplishment and Needs effort has been an important one. Unfortunately, however, the specific results which can be identified in the written document leave much to be desired and still more to be guessed.

Some Generalizations: This extensive analysis suggests some major accomplishments as well as some major needs for the future of science education for the 80's. Perhaps ending with some of these generalizations which are suggested by the efforts of the past year and a half is appropriate.

Some of the accomplishments in science education during the past two decades are:

1) Major involvement of the scientific community in defining the disciplines of science, in interpreting latest discoveries that are important as preparation for future living, in participating as a part of curriculum development teams.

2) New views of science education that include philosophical, historical, sociological, technological, and humanistic dimensions; recognition that these new views are as valid as organizers for learning experiences as are content and process schemes.

3) National concern for and interest in better science experiences for America's youth; renewed interest in science for all people.

4) Development of new materials which can be adapted to local situations; new instructional strategies with model materials to implement them.

5) Massive efforts to affect science curricula and teacher inservice programs.

6) Excellent preparatory sequences to enable students to prepare for advanced careers in science and technology.

7) Improved materials and facilities for appropriate science instruction.

Some of the needs for the future years include:

1) A new conceptualization of science education as a discipline, a reformulation of goals to meet the needs of a new society.

2) Inservice programs to assist professionals with implementing programs consistent with new goals.

3) Continued curriculum development to assure models for implementing new philosophy and new teaching strategies.

4) New programs for assessing all aspects of instruction and learning to provide information for planned changes and improvements.

5) New cooperative enterprises involving all segments of government, industry, and community groups as well as persons from all levels of the professional science education community.

6) New support systems, including personnel, learning centers, and communication links, to encourage change and professional growth.

7) New philosophical bases for research in order to test the validity of new conceptualizations and new directions.

REFERENCES

Butts, David P. and Robert E. Yager. "Science Educators' Perceptions of the Graduate Preparation Programs of Science Teachers in 1979." *Journal of Research in Science Teaching*, in press.

Bybee, Rodger and Robert E. Yager. "Science Education Needs a New Direction." *Science Education*, submitted for publication.

Gallagher, James J. and Robert E. Yager. "Science Educators' Perceptions of Problems Facing Science Education: A Report of Five Surveys." *Journal of Research in Science Teaching*, in press.

Harms, Harris and Robert E. Yager. "What Research Says to the Science Teacher, Volume 3." National Science Teachers Association Monograph, Washington, D.C., 1981.

Helgeson, Stanley L., Patricia E. Blosser, and Robert W. Howe. *The Status of Pre-College Science, Mathematics, and Social Science Education*: 1955-1975, Volume 1: Science Education. Washington, D.C., U.S. Government Printing Office, 1977.

Kahle, Jane B. and Robert E. Yager. "Current Indicators for the Discipline of *Science Education*." Science Education, in press.

Renner, John W. and Robert E. Yager. "Proposed Solutions for Perceived Problems in Science Education - 1979." *Science Education*, in press.

Science Education: Accomplishments and Needs. (A Working Paper by the National Science Teachers Association.) ERIC/SMEAC Clearinghouse for Science, Mathematics, and Environmental Education, The Ohio State University, Columbus, 1978.

Stake, Robert E. and Jack Easley, Jr. *Case Studies in Science Education*. Washington, D.C., U.S. Government Printing Office, 1978.

Weiss, Iris R. Report of the 1977 National Survey of Science, Mathematics and Social Studies Education. Washington, D.C., U.S. Government Printing Office, 1978.

What are the Needs in Pre-College Science, Mathematics, and Social Science Education? Views from the Field. National Science Foundation, Office of Program Integration, Directorate for Science Education. Washington, D.C., U.S. Government Printing Office, 1980.

Yager, Robert E. "Crisis in Science Education." Technical Report #21, Science Education Center, The University of Iowa, 1980.

Appendix A

Five Leadership Groups Used in the Evaluation of the Working Paper

ELEMENTARY TEACHERS

Rodean S. Anderson
Ruth K. Webb Elementary School
Washington, D.C. 20013

Alberta Andrews
64 Briarwood Road
West Hartford, CT 06017

Carolyn Angus
Children's House of Columbia
915 Maryland
Columbia, MO 65201

Tom Aunan
Helen Lemme School
3100 E. Washington
Iowa City, IA 52240

Cheryl Baader
Riverview Elementary
Baltimore, MD 21227

Dorothy E. Banks
Science Education
Watkins Elementary School
Washington, D.C. 20013

H. Leroy Barger
3416 Oak Hill Road
Wooster, OH 44691

Alana Barnes
Martinez Elementary School
341 14th Street
Greeley, CO 80631

Ruth R. Bornarth
Lincoln Hall Middle School
6855 North Crawford
Lincolnwood, IL 60646

Josephine Browne
1423 Sunnyside
Moscow, ID 83843

Miram R. Buckland
110 Hillcrest Park
Cos Cob, CT 06807

Barbara Busack
302 North Second Street
Olean, NY 14760

Tina Calaway
Cameron Elementary School
1424 13th Avenue
Greeley, CO 80631

Velma Campbell
Wyoming Middle School
17 Wyoming Avenue
Cincinnati, OH 45215

Andrew Carbone
52 Beacon Avenue
Jersey City, NJ 81306

Lanson Carney
Chinook Elementary School
3101 West 88th Avenue
Anchorage, AK 99502

Dorothy Cherry
Winfield Elementary
Baltimore, MD 21207

David C. Christiansen
1421 Delta Drive
Cedar Falls, IA 50613

Esther M. Coleman
11346 Memorial
Detroit, MI 48227

R. Barry Crowell
87 Sunnyvale Drive
Columbia, MO 65201

Harold S. Crowley, Jr.
3 Flagg Street
Quincy, MA 02170

Frank G. Day
Werutuck Elementary School
Haight Road
Amenion, NY 12501

Ursula Decker
17 Garson Road
Carle Place, NY 11514

Lucinda O. Denton
603 Smallwood Road
Rockville, MD 20850

Pamela DiCostanzo
Roton Middle School
Highland Avenue
Norwalk, CT 06820

Joan Duea
1409 West 18th
Cedar Falls, IA 50613

Marlene Eaton
334 Bascom Avenue, Apt. 108
Pittsburgh, PA 15214

Norma Erickson
Arlington Elementary School
9th Avenue and 23rd Street
Greeley, CO 80631

Lillian Eubaska
Chesapeake Terrace Elementary School
2122 Lodge Farm Road
Baltimore, MD 21224

Helen Ferguson
Ursa Minor Elementary School
6th and Hoonah, Ft. Richardson
Anchorage, AK 99505

Susan G. Fraunfelter
7915 Hillendale Road
Baltimore, MD 21234

Corinne Ginter
8933 Marmora
Morton Grove, IL 60053

Edith H. Gladden
1308 East Barringer Street
Philadelphia, PA 19119

Jennie Hasenei
Edmondson Heights
Baltimore, MD 21207

Gale Hoffman
Scotts Branch
Baltimore, MD 21207

Kathie Holmes
Centennial Elementary School
1400 37th Street
Evans, CO 80620

Russell G. Holmes
Pine Grove
Baltimore, MD 21234

Kathy Horning
Jefferson Elementary School
4th Avenue and 13th Street
Greeley, CO 80631

Carolyn J. Hudik
5259 South Wolcott Avenue
Chicago, IL 60609

Glenda K. Johnson
Woodbridge Elementary
Baltimore, MD 21228

JoAnne Jones
8304 Eastridge Avenue
Takoma Park, MD 20012

Russell H. Jones
Sussex Elementary
Baltimore, MD 21221

Eunice [illegible]plan
2410 Sugarcone Road
Baltimore, MD 21209

Carole Keister
Timonium Elementary School
Eastridge Road
Timonium, MD 21093

Joy Y. Kerby
Soddy Elementary School
School Street
Soddy, TN 37379

Rose Anne Kieler
238 Navajo Road
Pittsburgh, PA 15241

Helen Klepper
158 E. 28th Street
Riviera Beach, FL 33404

Charles E. Lewellen
107 Ridge Road
Toccoa, GA 30577

Janet Linde
116221 45th Street South
Seattle, WA 98188

Delores Lindsay
4075 Valley Brooke Terrace
College Park, GA 30022

Mark Lubbers
Shawsheen Elementary School
4020 West 7th Street
Greeley, CO 80631

Kathleen Malmgren
8656 Braewood Drive
Syracuse, NY 13027

Renee Mayer
Franklin School
818 35th Avenue
Greeley, CO 80631

Grace McArtor
Carroll Manor School
Baldwin, MD 21013

Virginia E. McCluer
McCluer Lane, Rt. 1, Box 475
O'Fallon, MD 63366

Mary C. McCurdy
7901 East Avon Lane
Lincoln, NB 68505

Mildred M. Moseman
216 East 31st
South Sioux City, ME 68776

Alice J. Moses
5726 South Drexel
Chicago, IL 60637

Donald O'Brian
Maplewood Middle School
1201 21st Avenue
Greeley, CO 80631

Larry J. Osborn
Scott Elementary
13th Street
Greeley, CO 80631

Margaret D. Patterson
Mars Estates School
Baltimore, MD 21221

Mary Pinamont
East Memorial School
614 East 20th Street
Greeley, CO 80631

Michael Pisarik
5817 Franklin
La Grange, IL 60525

John Plank
Culbertson Elementary School
3530 Groshen Road
Newtown Square, PA 19073

Sister Linda Preece
352 Elmdale
Akron, OH 44320

Ray R. Prince
3996 Wisteria Lane
Atlanta, GA 30300

Evelyn C. Pronko
1082 Raritan
St. Louis, MO 63119

Peggy Ratsch
Norwood Elementary
Baltimore, MD 21222

Martha Rice
1921 13th Street
Hickory, NC 28601

Alan Rosofsky
48 Winside Lane
Coram, NY 11727

Kathy Runyan
Brentwood Middle School
2600 25th Avenue Court
Greeley, CO 80631

Paul R. Sabino
Yalesville School
415 Church Street
Yalesville, CT 06492

Edward Saehler
Helen Lemme School
3100 E. Washington Street
Iowa City, IA 52240

Linda Sells
Winand Elementary School
Baltimore, MD 21208

Florence W. Singler
302 South Cedar
Nokomis, IL 62075

Carol M. Slizys
Woodbridge Elementary
Baltimore, MD 21228

Lee Smith
Creekside Park Elementary
7500 East 6th Avenue
Anchorage, AK 99504

Gregory Staples
Jefferson Elementary School
Wauwatosa, WI 53213

Marie K. Stavrides
125 Lake Avenue
St. James, NY 11780

Vicky Stoddart
Madison Elementary School
24th Avenue and 5th Street
Greeley, CO 80631

Darleen Stoner
1546 Hacienda Place
Pomona, CA 91768

Helen E. Stricblond
643 Lyric Way NW
Atlanta, GA 30300

Juday Studinger
9105 East Lehigh, #55
Denver, CO 80200

Janet E. Tanis
105 New England Avenue
Summit, NJ 07901

Laura A. Taubes
102 Penn Road
Scarsdale, NY 10583

Peggy Teters
3818 South Fairview
Springfield, MO 65807

Smithie E. Tuggle
2611 Embarcadero Drive
Lithonia, GA 30058

Joy Underdown
912 Fairview Road
Columbia, MO 65201

Donald A. Vannan
RD 5 Schattenhaus
Bloomsberg, PA 17815

Mary Verhein
Meeker Elementary School
2221 28th Avenue
Greeley, CO 80631

Cecelia Webber
204 Wiegel Drive
Ferguson, MO 63135

Barbara Whitman
Chappelow Middle School
3815 St. Vrain
Evans, CO 80620

Elaine Wilbourne
Hebbville Elementary
Baltimore, MD 21207

Patricia Williams
7528 Fielder Road
Jonesboro, GA 30236

Barbara Wilson
336 Redding Road
Lexington, KY 40507

Janice J. Withington
4070 Kendall Street
Wheat Ridge, CO 80033

Stuart Yager
Van Buren Elementary
Cedar Rapids, IA 52404

Kate Young
Kittrell Elementary
1520 Easton
Waterloo, IA 50702

Betty Zeitlow
Jackson Elementary School
2002 25th Street
Greeley, CO 80631

SECONDARY TEACHERS

Betty Abernathy
Fike High School
500 Harrison Drive
Wilson, NC 27893

Marie B. Allen
Needham High School
609 Webster Street
Needham, MA 02194

Frank Anderson
The Bolles School
7400 San Jose Boulevard
Jacksonville, FL 32217

Terry Baker
Schwab Junior High School
4370 Beech Hill
Cincinnati, OH 45223

H. Leroy Barger
Orriville Junior High School
Church Street
Orville, OH 44667

Clayton F. Barton
Hamden High School
2040 Dixwell Avenue
Hamden CT 06517

Gleen J. Bemisoerfer
North Davidson Senior High School
Route #10
Lexington, NC 27292

Jeanne E. Bishop
Westlake Schools
24525 Hilliard Road
Westlake, OH 49145

Ruth R. Bornarth
Lincoln Hall Middle School
6855 N. Crawford
Lincolnwood, IL 60646

Daryl Brager
Eagle Grove Community School
Eagle Grove, IA 50533

Carolyn Brockway
Washington High School
2205 Forest Drive Southeast
Cedar Rapids, IA 52403

Merideth Swanson Brown
Cape Fear High School
Highway 24E
Fayetteville, NC

Herbert Brunkhorst
Kennedy High School
4545 Wenig Road Northeast
Cedar Rapids, IA 52402

Adrienne Burnell
Franklin High School
Broad and Green Streets
Philadelphia, PA 19100

John Bycoskie
Science Department Chairperson
Downington High School
445 Manor Avenue
Downington, PA 19335

George Chapman
Dubuque Senior High School
1800 Clarke Drive
Dubuque, IA 52001

Ellen Cohen
Burry Bergtraum High School
411 Pearl Street
New York, NY 10010

Edward Currier
Wayne Middle School
Ontario Center, NY 14520

Eric S. Dahber
Scranton Middle School
Brighton Area Schools
Brighton, MI 48116

Gary Dewey
Holland Christian School
32 West 19th Street
Middle Holland, MI 49423

Pamela DiCostanzo
Roton Middle School
Highland Avenue
Norwalk, CT 06853

Gerald F. Dunn
Ames High School
20th and Ridgewood Avenue
Ames, IA 50010

Katherine Eby
Bowsber High School
3548 S. D. Tract Avenue
Toledo, OH 43614

Ruth Edwards
Holmes High School
25th Street & Madison Avenue
Covington, KY 41044

Patricia M. Ellen
Mathews Intermediate School
Box 338
Mathews, VA 23109

Michale H. Farmer
Riverside High School
Rural Route #8
Greer, SC 29651

Kenneth V. Fast
Kirkwood High School
801 West Essex
Kirkwood, MO 63122

R. D. Fox
David School
30 North Norwood
Hillsdale, MI 49242

Vincent G. Galasa
Bronx High School of Science
75 West 205th Street
Bronx, NY 10468

James Gardner
Milburn High School
Milburn, NY 07041

Sandra Gray
Central High School
423 East Central
Springfield, MO 65800

Nancy Griffin
P.K. Yonge Lab School
1080 Southwest 11th Street
Gainesville, FL 32601

Raymond H. Holiday
Palmer High School
2129 Essex Lane
Colorado Springs, CO 80909

Sarah Hamilton
Richmond Junior High School
P.O. Box 1748
Rockingham, NC 28379

Alice Hendrix
Woodridge Junior High School
1930 Bronson Avenue
Pennisula, OH 44264

Ricky Hicks
Boonville High School
P.O. Box 129
Boonville, NC 27011

Ryan L. Holderman
Springboro High School
1605 South Main Street
Springboro, OH 45066

Douglas C. Huggett
Waukesha North
2222 Michigan Avenue
Waukesha, WI 53186

Paul J. Hummer
Gov. Thomas Johnson High School
Frederick, MD 21701

James J. Hungerford
Marshalltown High School
1602 South 2nd Avenue
Marshalltown, IA 50158

Violet D. Hunsucker
Martin Junior High School
1701 Ridge Road
Raleigh, NC 27607

Frank W. Huss, III
Miami Trace High School
Washington, C.H., OH 43160

Michael C. Jackson
Lejeune High School
Camp Lejeune, NC 28542

Howard James
Musselman High School
Bunker Hill, WV 25413

Jerry Jividen
Brown Junior High School
228 S. Scranton Street
Ravenna, OH 44266

Jessie Jones
Beddingfield High School
Wilson, NC 27893

T.E. Keefe
George Washington High School
655 South Monaco Street
Denver, CO 80224

Sarah E. Klein
Roton Middle School
Highland Avenue
Norwalk, CT 06853

Robert Knights
Pentucket High School
West Newbury, MA 01985

Harry Kranepool
Bishop Loughlin Memorial
High School
357 Clermont Avenue
Brooklyn, NY 11238

Elaine W. Ledbetter
Tampa Senior High School
111 Harvester
Tampa, TX 79065

Evelyn O. Lenner
Abington High School
Abington, PA 19001

Paul Luke
Glenwood Middle School
7635 Glenwood Avenue
Boardman, OH 44512

Patricia Lupo
330 East 10th Street
Erie, PA 16502

Nadia Makar
Hudson Catholic School
790 Bergen Avenue
Jersey City, NJ 07303

Anne E. Mann
Bolles School
7400 San Jose Boulevard
Jacksonville, FL 32217

Ernest G. Marshburn
P.S. Jones Junior High School
9th and Bridge Street
Washington, NC 27889

Bradley Matthews
Noe Middle School
121 West Lee Street
Louisville, KY 40201

Robert McNeish
6901 North Charles Street
Towson, MD 21204

R. P. Mikesell
Gateway High School
Monroeville, PA 15642

Gloria J. Mitchell
Pamliro Junior High School
P.O. Box 128
Bayboro, NC 28515

James F. Moit
Lincoln-Sudbury Reg. High School
Sudbury, MA 01701

Theodore E. Molitor
1261 Highway 36
Alexander Ramsey Senior
  High School
Roseville, MN 58113

David E. Moore
Riverdale Senior High School
160 Robert Drive
Riverdale, GA 30274

Jaems E. Nix, Jr.
Central Gwinnett High School
564 Crogan Street
Lawrenceville, GA 30245

Linda K. Perez
J. Frank Dobie High School
11111 Beamer Road
Houston, Texas 77089

Dee Ploenes
Woodridge School
1930 Bronson Street
Pennisula, OH 44264

Larry E. Puled
200 West 6th
Rifle High School
Rifle, CO 81650

Walter G. Quint
West Deptford High School
Old Crown Point Road
Westville, NJ 08093

Diana H. Reinhard
Springbrook High School
201 Valleybrood Drive
Silver Spring, MD 20904

Helena Ridenhour
Carrington Junior High School
227 Milton Road
Durham, NC 22714

William R. M. Ritter
Upper Dublin School
800 Loch Alsh Avenue
Fort Washington, PA 19034

William B. Robertson
East High School
6800 Monroe Road
Charlotte, NC 28205

Valerie A. Sanford
Hilltop Preparatory School
South Ithan and Ay de Road
Rosemont, PA 19010

Cass Sanger
Adams County District #12
11285 Highline Drive
Northglenn, OH 80233

Annette M. Saturnelli
Marlboro High School
Marlboro, NY 12542

Frances V. Schoomaker
T.C. Williams High School
3330 King Street
Alexandria, VA 22300

Wylie Senter
Sequoyah High School
3456 Aztec Drive
Doraville, GA 30360

Paul H. Shiring
Burrell Senior High School
Lower Burrell, PA 15068

Madeline Simon
Bronx High School of Science
75 West 205 Street
Bronx, NY 10468

George F. Smeller
Wootten High School
20th and Ridgewood
Ames, IA 50010

Roger L. Spratt
Ames High School
20th and Ridgewood
Ames, IA 50010

Billy J. Stiles
Rabun County High School
Clayton, Ga 30525

Frances L. Stivers
Terry Parker High School
7301 Parker School Road
Jacksonville, FL 32211

Willis Swales
Pascack Valley Reg. High School
Piermont Ave.
Hillsdale, NY 07642

Jeane R. Swanton
Hudson Warde High School
Melville Avenue
Fairfield, CT 06430

Marten Tafel
Long Lub Junior High School
Westport, CT 06880

Dornetha Taylor
Covington High School
803 South College
Covington, TN 38019

Eleanor W. Thomas
Baton Rouge Magnet High School
2825 Gov't Street
Baton Rouge, LA 70806

Richard Tippett
Ridgely Junior High School
121 Ridgely Road
Lutherville, MD 21093

Millicent E. Tissair
Roger Ludlowe High School
Unquowa Road
Fairfield, CT 06430

Salcatore Tocci
East Hampton High School
2 Long Lane
East Hampton, NY 11937

Henry Vlug
Model Secondary School
for the Deaf
Kendall Green
Washington, D.C. 20002

Jan Wielert
Armstrong High School
1275 Tullar Road
Neenah, WI 54956

James C. Willan
Southern University Lab. School
Southern Branch PO
Baton Rouge, LA 70813

Harold Wiper
Newton North High School
360 Lowell Avenue
Newtonville, MA 02160

Ray Whitehouse
Central Junior High School
1012 Hancock Street
Quincy, MA 02169

James Wolter
1932 Southwest Third Street
Ankeny, IA 50021

Rick Zehr
Kennedy High School
4545 Wenig Road Northeast
Cedar Rapids, IA 52402

Frank Zverner
James Madison Memorial
201 South Gammon Road
Madison, WI 53700

SUPERVISORS

Merik Aaron
Carle Place Public Schools
Cherry Lane
Carle Place, NY 11514

Jane Abbot
Waterville High School
Brooklyn Avenue
Waterville, ME 04901

Verlin M. Abbott
Parkway School District
445 North Woods Mill Road
Chesterfield, MO 63017

John M. Akey
Mitchell High School
1205 Potter Drive
Colorado Springs, CO 80909

Katherine H. Aratani
The Kamehameha Schools
Kampalama Heights
Honolulu, HI 96817

Thomas J. Atkinson
Bethlehem Central School District
700 Delaware Avenue
Delmar, New York 12054

Ralph E. Bachus
Boulder Valley School District
6500 East Arapahae
Boulder, CO 80302

Essie C. Beck
Jefferson Parish School Board
519 Huey P. Long Avenue
Gretna, LA 70053

Charles W. Beehler
Rose Tree Media Schools
901 North Providence Road
Media, PA 19063

Carolyn Benne
Western Hills
1520 Morningside Avenue
Sioux City, IA 51109

Robert DeBlasi
Paramus Publis Schools
E99 Century Road
Paramus, NY 07652

Fred Blumenfeld
Milburn Senior High School
462 Milburn Avenue
Milburn, NJ 07041

Thomas A. Boehm
State Education Department
Room 302 EB
Albany, NY 12234

John Brennan
Denver Publis Schools
900 Grant Street
Denver, CO 80203

A. C. Brewer
Springfield R-12
940 North Jefferson
Springfield, MO 65807

Charles E. Butterfield
Ramsey High School
121 Brookside Avenue
Ramsey, NY 07446

Robert Carmichael
High Land Park High School
433 Vine
Highland Park, IL 60035

William L. Carmichael
North Georgia Cooperative Education
5 Westside Square
Ellijay, GA 30540

Dominick L Casulli
Dumont High School
Dumont, NJ 07628

B. G. Chambers
Knox County Schools
PO Box 2188
Knoxville, TN 37901

York H. Clamann
Abilene Independent Schools
842 North Mockingbird
Abilene, TX 79605

Warren Classon
Davenport School District
1022 Main Street
Davenport, IA 52803

Odie B. Cook
Oakland Unified School District
1025 Second Avenue
Oakland, CA 94606

Mary E. Corcoran
Winthrop Public Schools
Science Coordinator
Winthrop, MA 02152

Eleanor Davey
Xavier High School
242 East McLellan Boulevard
Phoenix, AZ 85012

Ralph DeLozier
Lemme
3100 Washington Street
Iowa City, IA 52240

Jerry Doyle
305 Avenue F
Fort Madison, IA 52627

Neal D. Eigenfeld
Milwaukee Public Schools
PO Drawer 10K
Milwaukee, WI 53201

Davie Fagle
Marshalltown Community School
317 Columbus
Marshalltown, IA 50158

Robert Fariel
Stanforth Junior High School
Elmont, NY 11003

Francis X. Finigan
Winchester Public Schools
15 High Street
Winchester, MA 01890

Louis Finsand
University of Northern Iowa
19th and Campus Streets
Cedar Falls, IA 50613

Clifford Foster
AGA 13
Box 1109
Council Bluff, IA 51501

Clifford T. Frederickson
San Diego City Schools
4100 Normal Street
San Diego, CA 92105

Jack Friedman
Syossett High School
Syossett, NY 11791

Gerald V. Garner
Los Angeles Unified School District
6625 Balboa Boulevard
Van Nuys, CA 91406

Particia B. Garrison
Science Consultant
Douglas County Schools
Douglasville, GA 30134

Louis A. Gatta
Glenvrook South High School
4000 West Lake Avenue
Glenview, IL 60025

Philip D. Gay
San Diego City Schools
4100 Normal Street
San Diego, CA 92103

Jack A. Gerlovich
Iowa Department of Public
Instruction
Grimes State Office Building
Des Moines, IA 50319

Richard S. Goodspeed
Glenvrook South High School
4000 West Lake Avenue
Glenview, IL 60025

308

David J. Hammond
San Juan Unified School District
3738 Walnut Avenue
Carmichael, CA 95608

Mary B. Harbeck
District of Columbia
  Public Schools
CBC Center 20th & Evarts Streets
Washington, D. C. 20018

Charles Hardy
Highline Public Schools
15675 Ambourn Boulevard
Seattle, WA 98166

Dean Hartman
Grant Wood
4401 Sixth Street
Cedar Rapids, IA 52404

Gilbert Hewett
3712 Cedar Heights Drive
Cedar Falls, IA 50613

Lester Hickman
720 Stadium Drive
Garland, TX 75040

Elizabeth J. Higgins
Chula Vista City School District
84 East J Street
Chula Vista, CA 90212

Richard Hirker
1040 Williams
Iowa City, IA 52240

Howard N. Hubbard
Long Beach Unified School District
701 Locust Avenue
Long Beach, CA 90813

Richard Kay
Idaho State Department
  of Education
650 West State Street
Boise, ID 83720

James K. Kelly
University of Northern Iowa
19th and Campus Streets
Cedar Falls, IA 50613

Bob King
NTAEA
Box M
Clear Lake, IA 50428

Arie R. Korporaal
Office of Los Angeles County
  Superintendent of Schools
9300 East Imperial Highway
Downey, CA 90242

Jean P. Krause
Weld County School District
811 15th Street
Greeley, CO 80631

David I. Kronenberg
Glen Cove High School
Dosor's Lane
Glen Cove, NY 11542

William K. Kumbier
Livonia Public Schools
15125 Farmington Road
Livonia, MI 48154

Robert Lewis
New Castle County School District
Springer Junior High School
Wilm, DE 19803

Lonnie Love
Georgia State Department
  of Education
207 Education Annex
Atlanta, GA 30334

George Magrane
AEA 15
Box 498
Ottumwa, IA

Vincent F. Malek
Deerfield High School
1959 North Waukegan Road
Deerfield, IL 60015

Carl J. Maria
Altoon Area School District
5th Avenue
Altoona, PA 16603

Donald E. Maxwell
Oakland Schools
2100 Pontiac Lake Road
Pontiac, MI 48054

Bernard M. McFadden
W.T. Clarke High School
Edgewood Drive
Westbury, NY 11590

Edgar McNeal
Cabell County Public Schools
Box 446
Huntington, WV 25709

Richard J. Merrill
Mount Diable Unified School District
1936 Carlotta Drive
Concord, CA 94519

Charles Moeckly
AEA 5
1235 Fifth Avenue South
Fort Dodge, IA 50501

Joe R. Moore
PO Box 330-A
Elkader, IA 52043

LaMoine L. Motz
Oakland Schools
2100 Pontiac Lake Road
Pontiac, MI 48054

Sister Lina Nadeau
Fall River Public School System
417 Rock Street
Fall River, MA 02720

Anna A. Neal
Fayette County Public Schools
701 East Main Street
Lexington, KY 40502

Timothy D. O'Connell
Milford Area Senior High School
West Street
Milford, NH 03055

David E. Olson
400 South Greenville
Richardson, TX 75081

John J. Padalino
Keystone Junior College
R. D. 1 Box 268
Dingmans Ferry, PA 18328

Donald Peck
Science Supervisor
Woodbridge Township Schools
Woodbridge, NJ 07095

W. G. Perrine
178 Barracks Street
Perth Amboy, NJ 08861

James A. Petrait
Benedictine High School
8001 West Outer Drive
Detroit, MI 48235

A. Q. Poeh
Tulsa Public Schools
3027 South New Have
Tulsa, OK 74145

Benjamin Poscover
Baltimore County Board of Education
6901 North Charles Street
Towson, MN 21204

Harold Pratt
Jefferson County Schools
1209 Quail
Lakewood, CO 80215

Elizabeth Kendzior Prusaitis
Jane Addams Middle School
905 Lily Cache Lane
Bolingbrook, IL 60439

Harold Rathert
1800 Grand Avenue
Des Moines, IA 50307

Rich Rief
Director of Planetarium
PO Box 25704
Albuquerque, NM 87125

John C. Rosemergy
Ann Arbor Public Schools
344 Gralake
Ann Arbor, MI 49103

Imogene Russell
Career Enrichment Center
PO Box 25704
Albuquerque, NM 87125

Lucy L. Smith
Instructional Service Center
2930 Forrest Hills Drive
Atlanta, GA 30315

Frank Starr
Waterloo Community Schools
1516 Washington Street
Waterloo, IA 50702

Dallas Stewart
Georgia Department of Education
Atlanta, GA 30334

Deane Stout
Knoxville City Schools
101 East Fifth Avenue
Knoxville, TN 37917

Hollis Dale Stout
Albuquerque Public Schools
PO Box 25704
Albuquerque, NM 87125

Piyush Swami
Retention,Promotion & Tenure Comm.
U of Cincinnati, College of Ed.
Cincinnati, OH 45221

Constance P. Tate
Baltimore City Public Schools
1401 East Oliver Street
Baltimore, MD 21213

Ray Thiess
Oregon Department of Education
700 Pringle Parkway
Salem, OR 97310

Jon R. Thompson
Colorado Coordinator EME
2417 Warwick Lane
Colorado Springs, CO 80909

Charles T. Vizzini
Charlotte-Mechlenburg School
428 West Boulevard
Charlotte, NC 28203

Joseph F. Walsh, Jr.
Boston Latin Academy
380 Talbot Avenue
Boston, MA 02124

Emma Walton
Anchorage School District
Pouch 6-615
Anchorage, AK 99502

Virginia A. Way
6055 Hoyt Court
Arvada, CO 80004

W. Donald Webb
Baltimore County Board of Education
6901 North Charles Street
Towson, MD 21204

Norma L. Wilbur
Office of Los Angeles County
Superintendent of Schools
9300 East Imperial Highway
Downey, CA 90242

Janice Withington
4070 Kendall
Wheatridge, CO 80033

TEACHER EDUCATORS

Gerald L. Abegg
261 Waltham Street
Lexington, MA 02173

Joseph Abruscato
311 Waterman Building
University of Vermont
Burlington, VT 05401

T. E. Allen
4910 Brandeis
San Antonio, TX 78249

Hans O. Anderson
204 Education Building
Indiana University
Bloomington, IN 47401

Ron Atwood
335 Dickey Hall
University of Kentucky
Lexington, KY 40506

Jerry F. Ayers
Box 5116
Tennessee Tech University
Cookeville, TN 38501

Joel Berger
3 Pilcher Street
Staten Island, NY 10314

Patricia E. Blosser
2606 Brandon Road
Columbus, OH 43221

Dean R. Brown
Department of Education
Colorado State University
Fort Collins, CO 80523

Rodger Bybee
Education Department
Carleton College
Northfield, MN 55057

Bruce D. Cheney
359 Erickson Hall
Michigan State University
East Lansing, MI 48824

Margaret Clark
Graduate Studies
Lewis & Clark College
Portland, OR 97219

Ronald Clemnson
Department of Curriculum and Instruction
Memphis State University
Memphis, TN 38152

Herbert Cohen
2127 East Fremont Drive
Tempe, AZ 85282

Esther M. Coleman
Box 224 Route 2
Afton, VA 22920

Ted Colton
Georgia State University
University Plaza
Atlanta, GA 30303

John Coulter
St. Cloud State University
Biological Sciences
St. Cloud, MN 56301

Paul Cowan
Post Office Box 5873
Denton, TX 76201

Arvin Crafton
311 Mason Hall
Murray State University
Murray, KY 42071

Jean Crawford
University of Windsor
Faculty of Education
Windsor, Ontario N9B 3PA

Rodney L. Doran
553 Baldy Hall
Amherst, NY 14260

Gary E. Downs
3809 Toronto
Ames, IA 50020

Marvin Druger
800 Biological Research Labs
Syracuse University
Syracuse, NY 13210

Clifford H. Edwards
Secondary Education/Foundations
#3 McKay Building
Provo, UT 84602

Thomas P. Evans
Department of Science Education
Oregon State University
Corvallis, OR 97331

R. K. Fletcher, Jr.
966 Briarwood Drive
Cookeville, TN 38501

Fred W. Fox
Department of Science Education
Oregon State University
Corvallis, OR 97331

Mel W. Fuller
College of Sciences
University of Arkansas
Little Rock, AR 72204

Ronald N. Giese
College of William and Mary
Williamsburg, VA 23185

William H. Glenn
Department of Teacher Preparation
York College City
University of New York
Jamaica, NY 11451

Daniel Goldthwaite
Department of Physics & Astronomy
University of Wisconsin
Oshkosh, WI 54901

Orrin Gould
1519 W. Charles Street
Champaign, IL 61820

Gene Hall
3-214 Education Annex
University of Texas
Austin, TX 78712

Richard E. Haney
Department of Curriculum and Instruction
University of Wisconsin
Milwaukee, WI 53201

Henry Heikkinen
12912 Claxton Drive
Laurel, MD 20811

Wayne Horine
University of Missouri
Raye and Prospect Street
Waynesville, MO 65583

Paul B. Hounshell
713 Greenwood Road
Chapel Hill, NC 27514

Harold R. Hungerford
Department of Curriculum, Instruction
and Media
Southern Illinois University
Carbondale, IL 62901

John P. Huntsberger
Science Education Center
University of Texas
Austin, TX 78712

Robert K. James
Holton Hall
Kansas State University
Manhattan, KS 66502

Brenda K. Johnson
RR 1 Box 169B
Volin, SD 57702

Gordon Johnson
3445 North 4th St.
Flagstaff, AZ 86001

Franklin Jones
4802 Radford University
Radford, VA 24142

Archie L. Lacey
168 Stayvesant Road
Teaneck, NJ 07666

R. W. Lefler
121 Hideaway Lane
W. Lafayette, IN 47906

313

Walter E. Lowell
Research Association
85 East Newton Street
Boston, MA 02162

Vincent N. Lunetta
Science Education Center
University of Iowa
Iowa City, IA 52242

Clark Markell
Minot State College
Minot, ND 58701

David May
Department of Education
Whitman College
Walla Walla, WA 99362

Clifford G. McCollum
University of Northern Iowa
Cedar Falls, IA 50613

Alan J. McCormack
1751 No. 15th Street
Laramie, WY 82070

Glenn R. McElhattan
118 Gilfillan Street
Franklin, PA 16323

E. Daniel McKenna
Chemistry Department
Concordia College
Moorhead, MN 56560

Ken Mechling
Biology Department
Clarion State College
Clarion, PA 11214

Lester C. Mills
McCracken Hall
Ohio University
Athens, OH 45701

James L. Milson
C & I Department
Univeristy of Texas
El Paso, TX 79968

Earl J. Montague
3923 Knollwood Drive
Austin, TX 78731

John J. Montean
61 Barbara Street
Scottsville. NY 14546

John N. Moore
136 Brody Hall
Michigan State University
East Lansing, MI 48823

David Ochs
7806 McCarthy Lane
Louisville, KY 40222

George T. O'Hearn
202 Warren Court
Green Bay, WI 54301

David H. Ost
California State College
Bakersfield, CA 93309

Theodore Y. Ozawa
Williamette University
Salem, OR 97301

Michael J. Padilla
Science Education
University of Georgia
Athens, GA 30602

Victor Perkes
Department of Education
University of California
Davis, CA 95696

Alvin M. Pettus
Division of Curriculum and Instruction
Virginia Polytechnical Institute &
State University
Blacksburg, VA 24061

Fred T. Pregger
Physics Department
Trenton State College
Trenton, NJ 08625

Richard J. Rezba
Virginia Commonwealth University
School of Education
Richmond, VA 23284

Dale Rice
3113 Gordon Drive
Greenville, NC 27834

Joseph P. Riley
212 Aderhold Hall
University of Georgia
Athens, GA 30602

William D. Romey
Department of Geology & Geography
St. Lawrence University
Canton, NY 13617

Pete A Rubba, Jr.
South Illinois University
RR 1 Box 178
Carbondale, IL 62901

John F. Schaff
College of Education
University of Toledo
Toledo, OH 43606

Donald Schmidt
Biology Department
Fitchburg State College
Fitchburg, MA 01420

Joseph S. Schmuckler
Chairman, Sci. Ed.
Ritter Hall, Temple University
Philadelphia, PA 19122

Victor M. Showalter
836 Park Drive
Bexley, OH 43209

James A. Shymansky
Science Education Center
University of Iowa
Iowa City, IA 52242

Gladys D. Sikora
17 E. 97th Street
New York, NY 10029

Ronald Simpson
209 Bryce Place
Cary, NC 27511

Sterling L. Smith
Box 23953
Denton, TX 76204

William R. Snyder
Rt. 3 Box 567 B
Tallahassee, FL 32308

Isadore L. Sonnier
University of Southern Mississippi
South Station Box 8202
Hattiesburg, MS 39401

Truman Stevens
1627 Duntreath Drive
Lexington, KY 40504

Edward Stoever
Department of Earth Sciences
Southeast Missouri State University
Cape Ciradeau, MO 63701

Darleen Stoner
Teacher Education
Claremont Graduate School
Claremont, CA 91711

David R. Stronck
P.O. Box 1700
University of Victoria
Victoria, B.C. V8W 2Y2

Frank Sutman
Temple University
School of Education
Philadelphia, PA 19122

Harold E. Tannenbaum
P.O. Box 295
Phoenicia, NY 12464

Thomas G. Teates
College of Education
Blacksburg, VA 24061

Frederick J. Thomas
Teacher Education
Miami University
Oxford, OH 45056

John F. Thompson
Department of Curriculum &
    Instruction
Memphis State University
Memphis, TN 38152

William Torop
690 Barclay Lane
Bromall, PA 19008

Verne Troxel
255 McGuffey Hall
Miami University
Oxford, OH 45056

L.W. Trowbridge
2001 21st Street
Greeley, CO 80631

Leon Ukens
325 Old Trail
Baltimore, MD 21212

Richard H. Weller
School of Education
University of North Carolina
Greensboro, NC 27412

Charles F. Williams
Department of Science Education
California State University
    Fullerton
Fullerton, CA 92634

Barbara Wofford
857 N. Chamberlain Avenue
Chattanooga, TN 37406

Emmett L. Wright
Schience Teaching Center
University of Maryland
College Park, MD 20742

Catherine Yeotis
College of Education Box 28
Wichita State University
Wichita, KA 67208

RESEARCHERS

Harold M. Anderson
School of Education
University of Colorado
Boulder, CO 80309

O. Roger Anderson
525 West 120 Street
New York, New York 10027

Ronald D. Anderson
School of Education
University of Colorado
Boulder, CO 80309

Betsy Balzano
Department of Curriculum &
Instruction
Brockport, NY 14420

Rolland B. Bartholomew
Science Education Center
University of Texas at Austin
Austin, TX 78712

James P. Barufaldi
Science Education Center
University of Texas at Austin
Austin, Texas 78712

Joel E. Bass
Department of Education
Sam Houston State University
Huntsville, TX 77340

Gary C. Bates
Science Education
Teachers College
Columbia University
New York, NY 10027

Paul C. Beisenherz
University of New Orleans
New Orleans, LA 70122

Carl F. Berger
1110 School of Education
University of Michigan
Ann Arbor, MI 48109

Lowell J. Bethel
Science Education Center
University of Texas at Austin
Austin, TX 78712

Howard Birnie
College of Education
University of Saskatchewan
Saskatoon Sask CANADA 57NOWO

Jacob W. Blankenship
Department of Curriculum &
Instruction
University of Houston
Houston, TX 77004

Milo Blecha
College of Education
Tucson, AZ 85721

F. David Boulanger
College of Education
University of Illinois
Chicago, IL 60680

Robert Vanden Branden
Memorial Hall
Drake University
Des Moines, IA 50311

Jane Bowyer
Mills College
Oakland, CA 94613

David P. Butts
Department of Science Education
University of Georgia
Athens, GA 30602

John Caldwell
Center for Teaching/Learning
University of North Dakota
Grand Forks, ND 58202

William Capie
212 Aderbold Hall
University of Georgia
Athens, GA 30602

Eugene L. Chiappetta
Department of Curriculum &
Instruction
University of Houston
Houston, TX 77004

Joseph Cotham
202 Education Building
Indiana University
Bloomington, IN 47405

Frank E. Crawley
Science Education Center
MLK & Speedway Streets
Austin, TX 78712

Frederick P. DeLuca
Room 253, Science I
Iowa State University
Ames, IA 50011

Linda R. DeTure
1049 Tuscany Place
Winter Park, FL 32789

Jack Easley
188 Education
University of Illinois
Urbana, IL 61801

Morris A. Enyeart
Science Education Center
Rutgers University
New Brunswick, NJ 08903

Fred N. Finley
226 Teacher Education
225 North Mills
Madison, WI 53706

Thaddeus W. Fowler
Teachers College
University of Cincinnati
Cincinnati, OH 45221

Dorothy L. Gabel
School of Education
Indiana University
Bloomington, IN 47405

Marjorie Gardner
National Science Foundation
Washington, D.C. 20550

Lynn W. Glass
12 Quadrangle
Iowa State University
Ames, IA 50011

Stephen F. Godomsky
Franklin Hall
University of Maine
Farmington, ME 04938

Jack Hassard
Georgia State University
Atlanta, GA 30303

William G. Holliday
University of Calgary
Calgary, Alberta CANADA T2N1N4

Willis Horak
1765 West Niona Place
Tucson, AZ 85704

Jerry Horn
Holton Hall, College of Education
Kansas State University
Manhattan, KS 66506

Ann C. Howe
101 Heroy
Syracuse University
Syracuse, NY 13210

Paul DeHart Hurd
Stanford University
549 Hilbar Lane
Palo Alto, CA 94303

J.W. George Ivany
Simon Fraser University
Burnaby, B.C. V5A 1S6

K.G. Jacknicke
Department of Secondary Education
University of Alberta
Edmonton, Alberta CANADA T6G 2G5

Delmar Janke
Department of Education
Texas A & M University
College Station, TX 77843

Harold H. Jaus
Education Building
Purdue University
West Lafayette, IN 47907

Brenda K. Johnson
R 1 Box 169 B
Volin, SD 57072

Jane Johnston
Moorhead State University
Moorhead, MN 56560

Edward E. Jones
Teacher Education
Miami University
Oxford, OH 45056

Howard L. Jones
Department of Curriculum &
Instruction
University of Houston
Houston, TX 77004

Paul Joslin
College of Education
Drake University
Des Moines, IA 50311

Jane B. Kahle
Department of Biological Science
& Science Education
Purdue University
West Lafayette, IN 47907

Robert Karplus
Lawrence Hall of Science
University of California
Berkeley, CA 94720

Heidi Kass
Department of Secondary Education
University of Alberta
Edmonton, Alberta CANADA T6G 2G5

Leo E. Klopfer
Learning Research Center
University of Pittsburgh
3939 O'Hara Street
Pittsburgh, PA 15260

John J. Koran, Jr.
College of Education
Norman Hall 360
University of Florida
Gainesville, FL 32611

William C. Kyle, Jr.
Science Education Center
University of Iowa
Iowa City, Iowa 52242

Bill LaShier
School of Education
University of Kansas
Lawrence, KS 66045

Steve Likins
Ohio State University
286 Arps Hall
Columbus, OH 43210

Joy S. Lindbeck
College of Education
University of Akron
Akron, OH 44325

Marcia C. Linn
Lawrence Hall of Science
University of California
Berkeley, CA 94720

Lawrence Lowery
4651 Tolman
University of California
Berkeley, CA 94720

George G. Mallinson
3409 Sangren Hall
Western Michigan University
Kalamazoo, MI 48008

Edmund A. Marek
Biology Department
Southwest Texas State University
San Marcos, TX 78666

Glenn Markle
608 Teachers College
University of Cincinnati
Cincinnati, OH 45221

Floyd E. Mattheis
East Carolina University
Greenville, N.C. 27834

Victor Mayer
1945 North High Street
Columbus, OH 43210

Ashley Morgan
University Plaza
Georgia State University
Atlanta, GA 30303

Carl J. Naegele
Science & Mathematics Teaching Center
Michigan State University
East Lansing, MI 48824

Joe Novak
Stone Hall
Cornell University
Ithaca, NY 14850

James Okey
Department of Science Education
University of Georgia
Athens, GA 30602

Roger G. Olstad
College of Education
University of Washington
Seattle, WA 98195

Milton Pella
Teacher Education Building
225 North Mills Street
Madison, WI 53706

John E. Penick
Science Education Center
University of Iowa
Iowa City, IA 52242

Rita W. Peterson
Department of Teacher Education
California State University
Hayward, CA 94542

M.D. Piburn
Science Education Center
10 Seminary Place
Rutgers University
New Brunswick, NJ 08903

Martha K. Piper
College of Education
University of Houston
Houston, TX 77004

Chester E. Raun
RH 451
Temple University
Philadelphia, PA 19122

Ronald J. Raven
State University of New York
Amherst, NY 14260

Sidney Rosen
341 Astronomy
University of Illinois
Urbana, IL 61801

Richard L. Sagness
College of Education
Idaho State University
Box 8059
Pocatello, ID 83209

Dorothy M. Schlitt
426 Education Building
Florida State University
Tallahassee, FL 32306

Livingston S. Schneider
Lawrence Hall of Science
University of California
Berkeley, CA 94720

Daniel S. Sheldon
Science Education Center
University of Iowa
Iowa City, IA 52242

Robert D. Sherwood
Education 202
Indiana University
Bloomington, IN 47405

Ellen Simmons
4315 Martha Avenue
Woodlawn Heights
New York, NY 10470

Craig Sipe
316 Sunya Station
Albany, NY 12222

Herbert A. Smith
110 Administration Building
Colorado State University
Fort Collins, CO 80523

Richard A. Smith
Natural Science Department
San Jose State University
San Jose, CA 95192

Frank L. Sullivan
Biology Department
Salem State College
Salem, MA 01970

Dennis W. Sunal
Department of Curriculum & Instruction
West Virginia University
Morgantown, WV 26506

Michael Szabo
201 Chambers
Penn State University
University Park, PA 16802

Leverne J. Thelen
School of Education
University of Massachusetts
Amherst, MA 01003

David F. Treagust
Science/Math Teaching Center
Michigan State University
East Lansing, MI 48824

Doris A. Trojcak
University of Missouri
8001 Natural Bridge Road
St. Louis, MO 63121

Fletcher Watson
Press 23
32 Washington Place
New York, NY 10003

Wayne W. Welch
210 Burton Hall
University of Minnesota
Minneapolis, MN 55455

Paul Westmeyer
University of Texas
San Antonio, TX 78285

John T. Wilson
Science Education Center
University of Iowa
Iowa City, IA 52242

Robert E. Yager
Science Education Center
University of Iowa
Iowa City, IA 52242

Russell H. Yeany
212 Aderbold Hall
University of Georgia
Athens, GA 30602

Anton E. Lawson
Department of Physics and Science Education
Arizona State University
Tempe, AZ 85281

Mary Keegan
Winnetka Public Schools
1110 Chatfield Road
Winnetka, IL 60093

Appendix B

The Instrument Used to Assess the Validity of the Working Paper

Evaluation of NSTA Working Paper:

Science Education: Its Accomplishments and Needs

Introduction

In December, 1978, the National Science Teachers Association published the report entitled Science Education: Accomplishments and Needs which you are asked to evaluate. The report has caused controversy among science educators. That controversy is focused around whether or not the report actually does and does accurately and adequately what the title implies.

The Research Committee of NSTA requests your opinion regarding the following statements, questions, and issues as related to the text of the working paper published by ERIC/SMEAC. Please make comments concerning each item and provide examples which illustrate your assessment.

Each section in this questionnaire is parallel with the corresponding section in the report. There is, for example, a section in the report on "The Aims of Science Teaching"; there is a similar section in this questionnaire.

Each section of the questionnaire contains summary statements which represent the content of that section. Each summary statement is followed by a question or a statement requesting you to make a comment. Please make such comments concerning the value of the point to science education which are made in the report and represented by the summary statements. These comments, especially when there is a great variation in responses among respondents, will be analyzed very carefully. On the right-hand side of the page indicate how you value the point in the report being explained by the summary statement. This will give us some general information on each area of the report from each of the respondent groups. In other words, both your general impressions and the comments are desired.

After each section space is provided for you to offer a general critique of that section of the paper. We are interested in specific disagreement(s) which you may have to the statements in the paper. As with the request for comment regarding each item on the questionnaire, these criticisms of each section of the paper will give the research analysts valuable insights concerning the accuracy and adequacy of the Working Paper.

AN EVALUATION OF THE NSTA - ERIC/SMEAC WORKING PAPER ENTITLED:
"SCIENCE EDUCATION: ITS ACCOMPLISHMENTS AND NEEDS"

Please use the following designations in indicating your evaluation of forty-one statements which follow:

1. Strongly agree
2. Agree
3. Neither agree nor disagree
4. Disagree
5. Strongly Disagree

INTRODUCTION

1. The interdependence of science teaching and society is an appropriate starting point in considering the accomplishments and needs of science education today. __________ 1 2 3 4 5

Comments: ____

____

____

2. Societal problems of today should provide the most significant influence upon science teaching for the 1980's. __________ 1 2 3 4 5

Other factors and comments: ____

____

____

What is your general reaction to the section of the paper entitled "Introduction"? List some specific points where you disagree with statements made by the authors.

____

____

____

____

____

THE AIMS OF SCIENCE TEACHING

3. There has been general agreement among science educators for the past forty years concerning the goals of instruction for school science. ______ 1 2 3 4 5

What are such major goals? ______________________________

____

____

4. The NSTA description of a scientifically literate person is as accurate for the 1980's as it was in 1964. ______ 1 2 3 4 5

Comments including new features for a scientifically literate person for the 1980's: ______________________________

____

5. Current goals for science education are in a period of significant transition. ______ 1 2 3 4 5

Describe causes and/or new direction: ______________________________

____

____

6. Change with respect to goals, curriculum, and teaching strategies are inherent to science education. ______ 1 2 3 4 5

Comments: ______________________________

____

____

What is your general reaction to the section of the paper entitled "The Aims of Science Teaching"? List some specific points where you disagree with statements made by the authors.

____

____

____

____

PRESENT SITUATION OF SCIENCE TEACHING

7. Achievements in the development of science curriculum materials during the 1959-79 period have been significant.

1 2 3 4 5

Comments and/or support for view

8. NSF support for teacher education 1959-79 resulted in major changes in teacher behavior.

1 2 3 4 5

Comments on other outcomes of the NSF support for Institutes:

9. The National science programs of the 1960's and early 70's illustrate the directions for new programs and teacher strategies for using them for the 80's.

1 2 3 4 5

Comments:

10. The major need for science teachers of the 80's relates to their knowing more about the strategies they use for meeting their goals.

1 2 3 4 5

Comments as to needs for new approaches to teaching science:

11. Population trends in the U.S. represent a major area of concern for science teaching for the 1980's.

1 2 3 4 5

Comments:

12. The current decline in funding for science education and that anticipated for the 1980's is a major area for concern.

1 2 3 4 5

Comments:

13. The decline in numbers of students enrolled in the science curriculum presently is a primary cause for alarm for science education for the 80's. ________ 1 2 3 4 5

Comments:____

____

____

14. The concern for accountability and competency-based programs is a major area of concern for science education for the 80's. ________ 1 2 3 4 5

Comments:____

____

____

15. School students are vastly different today, a fact which causes major concerns for science teaching for the 1980's. ________ 1 2 3 4 5

Comments:____

____

____

16. Teacher unionization presents a major change and concern for science instruction of the 1980's. ________ 1 2 3 4 5

Comments:____

____

____

What is your ranking of the six concerns (numbers 11-16 above)? ________ 1 2 3 4 5

____

____

What do you consider to be other (or even more important) concerns regarding science education today which are likely to impact science education for the 1980's? ________________________________

____

____

____

What is your general reaction to the section of the paper entitled "Present Situation of Science Teaching in the U.S."? List some specific points where you disagree with statements made by the authors.

____

____

____

____

RECOMMENDATIONS FOR THE COMING YEARS

17. A shortage of suitable materials for science in the elementary school should be corrected; suitable material includes that which combine science with reading, mathematics, and other areas of the program.

____
1 2 3 4 5

Comments:____

____

____

18. The junior high school program is one where great diversity in content and teaching method should reflect the great diversity among early adolescents.

____
1 2 3 4 5

Comments:____

____

____

19. Laboratories in which students encounter problems in science should be encouraged since they tend to motivate students.

____
1 2 3 4 5

Comments:____

____

____

20. Laboratories in science should be encouraged since they tend to improve student attitudes toward science.

____
1 2 3 4 5

Comments:____

____

____

21. The traditional offerings in science at the high school level should be expanded and organized in ways other than by discipline, especially in K-12 programs. 1 2 3 4 5

Comments:

22. Science programs for the community colleges should be more flexible and variate more than programs for other academic levels. 1 2 3 4 5

Comments:

23. Laboratories should be considered vital parts of science courses at the college level. 1 2 3 4 5

Comments concerning the trend for fewer laboratories, especially in introductory courses:

24. All prospective elementary education majors should complete formal study in each of the geological, physical, biological, and earth science areas. 1 2 3 4 5

Comments:

25. K-12 teacher preparation programs should provide more adequate preparation in science content. 1 2 3 4 5

Comments:

What are other major problems you perceive? (Asterick those you consider greater than content preparation.)

26. Teaching science as inquiry should be a major goal for exemplary science teaching, K-12. 1 2 3 4 5

Comments:

27. Improving teaching strategies in science education should be a major concern for the 1980's. 1 2 3 4 5

Comments:

28. More attention should be given to needed laboratory equipment, supplies, and budget increases for the 1980's. 1 2 3 4 5

Comments:

29. Renewed attention to in-service teacher education should be a major concern in science education as 1980 approaches. 1 2 3 4 5

Comments:

30. Science coordinators, consultants, and/or supervisors should be encouraged at local, regional, and state levels; a major shift toward employing more support staff is needed to reverse adverse trends in science education. 1 2 3 4 5

Comments:

31. Increased communication and research involving schools with pre-service teacher education programs should be a major effort for the 1980's. ___ 1 2 3 4 5

Comments: ______________________________

32. Competency-based teacher education should be encouraged because of its importance and potential impact on science education ___ 1 2 3 4 5

Comments: ______________________________

33. The involvement of the community in science curriculum, teaching, and student experiences should be encouraged as a way to improve science education for the 1980's. ___ 1 2 3 4 5

Comments: ______________________________

34. Research in science education should be encouraged as a means for changing classroom practice. ___ 1 2 3 4 5

Comments: ______________________________

35. More cooperation should be encouraged between researcher and practitioner to produce research with more practical value in affecting education for the 1980's. ___ 1 2 3 4 5

Comments: ______________________________

36. The encouragement of women and minority students in science should be a major priority needing attention for the 1980's. ___ 1 2 3 4 5

Comments: ______________________________

37. NSF should give a higher priority to projects for disseminating and implementing new science curricula. 1 2 3 4 5

Comments:

38. NSF should give a higher priority to projects designed to provide in-service education for teachers of science. 1 2 3 4 5

Comments:

39. Budgetary restraints at the federal level provide a great problem for science education for the 80's; increased financial support for science education should be given attention for the next decade. 1 2 3 4 5

Comments:

40. The science education should be constantly concerned with assessing its needs, defining its problems, and establishing goals. 1 2 3 4 5

Comments:

What is your general reactionto the section of the paper entitled "Recommendations for the Coming Years"? List some specific points where you disagree with statements made by the authors.